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VOLUME XVI.

1928.

WITH TWENTY-FOUR PLATES AND ONE MAP.

CAPE TOWN:

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A NEW METHOD OF AERIAL SURVEYING. (SECOND PAPER.)

By H. G. FOURCADE.

(With five Text-figures.)

The general mathematical solution for an aerial traverse was given in a former paper.* In the present paper the adjustment of a traverse to terminal conditions is considered and various other developments are added.

In photographing strips of country from the air, the aim is to take the photographs at nearly equal intervals, and while flying straight and level. With suitable arrangements and proper training, "when the pilot is flying in fair weather at a height sufficient to escape air pockets, the probable errors of tilt and flying height have been reduced to 1° and 40 feet respectively." † For the purpose of computation of weights, it is therefore sufficient to consider the air bases as being approximately equal and in a straight line. The circuit corrections being all small, it is also justifiable to apply each one independently of the others.

A. *Adjustment of Bases.*—(*a*) The initial and terminal bases, determined independently, are considered fixed. Two values, l'_m and $l'_m(1+k)$, result for each of the intermediate bases, $(1+k)$ being the ratio of the adopted length of the terminal base to its length computed from the initial base. The relative weights of the direct and reverse values for each base are then—

Bases	l_0	l_1	l_2	. . .	l_m	. . .	l_n
Weights direct	∞	1	$\frac{1}{2}$	. . .	$\frac{1}{m}$	. . .	0
,, reverse	0	$\frac{1}{n-1}$	$\frac{1}{n-2}$	. . .	$\frac{1}{n-m}$	. . .	∞

* Trans. Roy. Soc. S. Afr., vol. xiv, pt. 1, 1926, p. 93.

† Report of the Air Survey Committee, War Office, London, 1923, p. 11.

and the weighted mean of the length of a base l_m is

$$l_m = l'_m \frac{\frac{1}{m} + \frac{1+k}{n-m}}{\frac{1}{m} + \frac{1}{n-m}} = l'_m \left(1 + \frac{m}{n} k\right).$$

Relative weight of weighted mean

$$\frac{1}{m} + \frac{1}{n-m}.$$

(*b*) Let D be the known horizontal distance, reduced to height above sea-level, between the initial and terminal stations of the traverse. Compute

$$D' = l_0 \cos i_0 \cos \alpha_0 + l_1 \cos i_1 \cos \alpha_1 + \ . \ . \ . \ + l_n \cos i_n \cos \alpha_n.$$

Where i_0, i_1, etc., are the inclinations of the bases and α_0, α_1, etc., the angular differences between the directions of the bases and that of the line joining the first and last points. Then

$$L_m = l_m \frac{D}{D'}.$$

Or, if greater precision be wanted, the discrepancy $D - D'$ may be distributed according to the weights of the bases in the same manner that the error of closure of a triangle is distributed according to the weights of the observed angles.

B. *Adjustment of Twist.*—Let $\Delta\lambda$ be the difference between the computed and the adopted polar bearings of the terminal pair. The correction to the polar bearings of any intermediate pair will then be, proceeding as for A (*a*) above,

$$\Delta\lambda_m = \frac{m}{n} \Delta\lambda.$$

C. *Adjustment of Inclinations.*—Let Δi be the difference between the computed and adopted inclinations of the terminal base. We have first

$$\Delta' i_m = \frac{m}{n} \Delta i.$$

Compute $$h' = l_0 \sin i_0 + l_1 \sin i_1 + \ . \ . \ . \ + l_n \sin i_n.$$

If the actual difference in height between the initial and terminal points is h, we get

$$\Delta i_m = \frac{h' - h}{D} + \frac{m}{n} \Delta i.$$

D. *Adjustment of Directions.*—Let Δa be the terminal discrepancy. We have again

$$\Delta' a_m = \frac{m}{n} \Delta a.$$

These first corrections having been applied to the directions of the bases, compute

$$P = l_0 \cos i_0 \sin a_0 + l_1 \cos i_1 \sin a_1' + \ . \ . \ . \ + l_n \cos i_n \sin a_n.$$

Then

$$\Delta a_m = -\frac{P}{D} + \frac{m}{n} \Delta a.$$

The foregoing completes the account given, in the author's previous paper, of the reduction of an aerial traverse by computation. The computations are sufficiently simple to be practical. But a further great simplification may be effected by using the instrument for the direct determination of some of the results, as will now be shown.

Transfer of Vertical Point.—In the previous paper the remark was made that "if it were possible to indicate the vertical point z on the plates, the values of i, ψ, ϕ, and θ could be read directly on the stereogoniometer and no computations would be needed for setting the mapping attachment, or for carrying on an aerial traverse." In writing thus a valuable property of the instrument was overlooked.

When a pair of plates have been set in correspondence, and rotated together until the vertical plane containing the air base is brought into the measuring plane of the apparatus, the vertical points P, P' (fig. 1) on the two plates will be indicated by the rays, making an angle $90° + i$ with the base. If these two points can be marked on the plates, as will be provided for presently, the inclinations α and β of the plates will be measurable directly by rotating the position circles until P is brought into the plane OAB, and P' into the plane $O'AB$, when, by bringing successively OP and OP' into the measuring plane of the instrument, the angles α and β may be read on the declination circles. The readings on the position circles will then also give the directions of the inclinations of the plates. The two rays AP and BP' should not be quite parallel, the forward ray being made to converge by an amount equal to the curvature, approximately $32''{\cdot}4$ per 1000 m. of the length of the base.

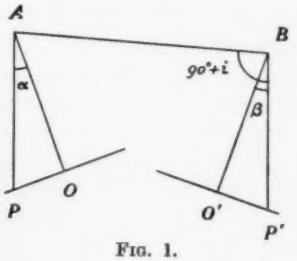

FIG. 1.

To pass from one pair of plates to the next, set in the instrument the linked plates connecting the two pairs, with their y-axes perpendicular to the polar axis, their centres at the same height, and each inclined to the polar axis by half the angle between the pair. Bisect the known vertical point on one of the plates. A parallel ray to the other plate will indicate its vertical point.

To mark the vertical point temporarily a movable marker, which need only have a small range of motion, is carried on one side of the position circle by a cross-slide worked by two screws. The marker is removable when no longer needed. While in use the mark rotates with the position circle and remains a fixed point on the plate. The mark does not quite touch the plate and its cell carries a weak lens to bring it into the same focus as the plate. The lateral displacement of the mark caused by the lens remains constant after the mark has been set, and is therefore of no consequence.

The accuracy of the direct measurements of the inclinations and deviations of the plates should not be less than that of computed values because the latter have to be derived from other measurements subject to similar errors.

The computations now reduce to those of direction angles given, as before, by

$$\sin(a_p - \alpha) = \sin \Delta \sin(\lambda + \theta) \operatorname{cosec} i$$
$$\sin(a_2 - a_1) = \sin \nabla \sin \psi_1 \operatorname{cosec} i_2$$
$$\sin(a_p - a_2) = \sin \Delta_2 \sin i_2 \operatorname{cosec} \theta$$
$$\sin(a_p - a_3) = \sin \Delta_3 \sin i_3 \operatorname{cosec}(\lambda + \theta).$$

In the former paper it should have been mentioned that, the convergence of meridians not being considered, azimuths α at the first station become angles of direction at succeeding stations and intermediate points.

The computation of direction angles may also be dispensed with if we are content to assemble the sheets as is done for "mosaics." The terminal discrepancy $\Delta\alpha$ is in this case given by the difference in direction of the line joining the first and last stations on the mosaic when the initial and terminal sheets are successively placed in their correct positions on the map. P is then given by the distance apart of the terminal points in the two positions of the sheets.

Terminal Connections.—The instrument can also be made to give the inclination i of the first base and the polar angle θ of the first plate by a method requiring very little computation.

After a pair of plates have been set in correspondence, the tracing point of the mapping attachment may be made to trace in space a figure similar to that of any figure of the surface represented by the pair of photographs, and the corresponding plane figure drawn on the board will always be an

orthographic projection on the plane of the board of the three-dimensional figure traced by the point. If i and θ are provisionally assumed to be both zero, the maximum resulting errors in the relative lengths of any two lines of the projection will depend on the cosines of i and θ.

When flying at 10,000 feet, and the axes of the cameras are set at 20° from the vertical, the normal length of each base is 7280 feet. It results from the particulars previously given that the probable values of θ and i may, with suitable arrangements, be reduced to 40′ and under 30′. The maximum value of θ or i will thus seldom exceed 2°, so that an accuracy of 1 in 360 will usually be sufficient for finding θ or i to the nearest 10″. This allows of a partly graphical method being used for the purpose.

If the inclinations of the sides of the triangle of reference do not exceed 2° it may be computed that the lengths of the projections of these sides on the plane of the board will not differ by more than 1 in 500 from the corresponding lengths after the corrections θ and i have been applied. The projected triangle may therefore be used at once for computing θ and i. Its scale is found by comparing the lengths of the projected sides with their known lengths.

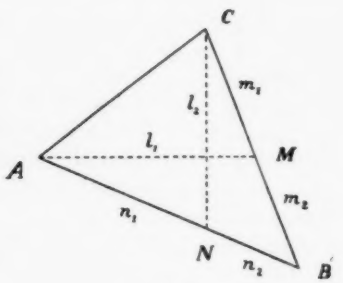

FIG. 2.

Let ABC (fig. 2) be the triangle projected on the board. Draw $AM=l_1$ and $CN=l_2$, perpendicular and parallel respectively to the inclination axis of the board, and read on the height scale of the board the heights h_a, h_b, and h_c of A, B, and C. Let h'_a, h'_b, h'_c be the known heights of A, B, C, reduced to the scale of the drawing. We have

$$h_m=\frac{m_1h_b+m_2h_c}{m_1+m_2} \qquad h'_m=\frac{m_1h'_b+m_2h'_c}{m_1+m_2}$$

$$\tan i=\frac{h'_m-h_m-h'_a+h_a}{l_1}.$$

Similarly,

$$h_n=\frac{n_1h_b+n_2h_a}{n_1+n_2} \qquad h'_n=\frac{n_1h'_b+n_2h'_a}{n_1+n_2}$$

$$\tan \theta=\frac{h'_n-h_n-h'_c+h_c}{l_2}.$$

The accuracy needed being under 1 in 500, the computations may be performed with a slide-rule.

When i and θ are both zero, inclination of the sides of the triangle of reference introduces no error in the projection. A second approximation after setting i and θ will therefore be sufficient in cases where the inclinations exceed 2°.

The method may be used exclusively for mapping the topography of areas in which there are enough known points to fix every pair of plates independently. Gaps in the ground control could be filled up by reverting to traverse. In flat country it may often become sufficient to level the drawing-board relatively to the pair of photographs by adjusting in turn the inclination i and the polar angle θ until the mark apparently travels on the surface of the ground along two directions at right angles.

Lieut. M. Hotine, R.E., Research Officer to the Air Survey Committee, has made the interesting suggestion that single stations at the terminals, instead of clusters of 3, may prove sufficient for fixing the strips of photographs. The ground control would then be limited to a primary triangulation along the sides of which a framework of strips of photographs is established.

Starting from an assumed value of the length of the first base of a traverse, and an assumed value, which may be zero, of its inclination, the terminal connections yield the inclinations and lengths of all the bases, and no further adjustment of either inclinations or lengths will be needed. θ remains to be found.

The equation, at p. 102 of the previous paper, giving the vertical co-ordinate of a point, was

$$h=M(\cot A \sin i-\cos(\lambda+\theta)\cos i),$$

reducing, when i and θ are small angles, to

$$h=M(i \cot A-\cos\lambda+\theta\sin\lambda),$$

in which

$$M=\frac{l \sin A \sin B}{\sin(A+B)}.$$

Putting a for $M(i \cot A-\cos\lambda)$ and b for $M \sin\lambda$, we get

$$h=a+b\theta.$$

If AB and $A'B'$ are the two air bases above a terminal station S, the condition for the height of a point P, referred to S, to be equal in the two systems of co-ordinates having respectively A and A' for origin, is that

$$h_p-h_s=h'_p-h'_s.$$

Similarly, for another point Q,

$$h_q-h_s=h'_q-h'_s,$$

the resulting equations being

$$(a_p-a_s)+(b_p-b_s)\theta=(a'_p-a'_s)+(b'_p-b'_s)\theta'$$
$$(a_q-a_s)+(b_q-b_s)\theta=(a'_q-a'_s)+(b'_q-b'_s)\theta'$$

determining θ and θ' for the bases AB and $A'B'$ respectively. The next step is to compute θ and θ' for the bases over the other two stations of the primary triangle. The six terminal pairs of plates being now considered fixed, the circuit adjustments may proceed as before, except that the adjustment of the lengths and inclinations of the bases is already complete. The points P and Q should be chosen close to the vertical planes of AB and $A'B'$ respectively, and as distant from S as practicable.

An approximate graphical method may also be employed for determining θ. The co-ordinates of two points P and Q, situated as before, are first computed in both systems on the assumption that $\theta=0$, and then plotted on a sufficiently large scale. Let P_1, P_2, be the two positions found for P. Draw perpendiculars from P_1 on AB and from P_2 on $A'B'$. The intersection of the perpendiculars will be, approximately, the position of P with reference to AB and $A'B'$. θ is then obtained from

$$\sin\theta=PP_1/z,$$

where z is the vertical coordinate of P_1 in the AB system. θ' is found by a similar construction for Q.

Computation of Lengths of Bases.—A method, more direct than that given in the previous paper, is the following :—

Let (fig. 3) $AB=l_0$ and $BC=l_1$ be two consecutive air bases, and P any point common to the two pairs of plates, that is in the overlap between the pair of linked plates at B. We can get the angles A, B_1, B_2, C from direct measures in the instrument. Then

$$BP=l_0\sin A\ \mathrm{cosec}\ (A+B_1)$$
$$l_1=BP\sin(B_2+C)\ \mathrm{cosec}\ C,$$

whence

$$l_1=l_0\frac{\sin A\sin(B_2+C)}{\sin C\sin(A+B_1)}.$$

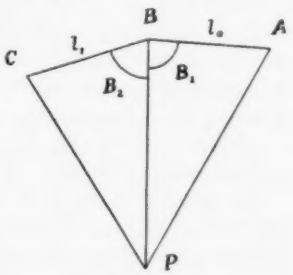

Fig. 3.

Obviously ABP and CBP need not be in one plane. A second point P' will provide a check. For identifying the points P, P', a ring should be drawn round them, on the back of each of the plates of the linked pair, using a diamond, or special ink for glass, for the purpose.

The lengths of the bases may also be obtained by graphical construction of the triangles.

Setting of Plates in Correspondence.—In the former method it was sought to establish correspondence by means of points only, a terminal discrepancy resulting, which was then removed. An improved method in which the settings in declination are made to depend upon a separate correspondence in polar angles, with the result that the three settings, for centres, for position angles, and for declinations, become practically independent of

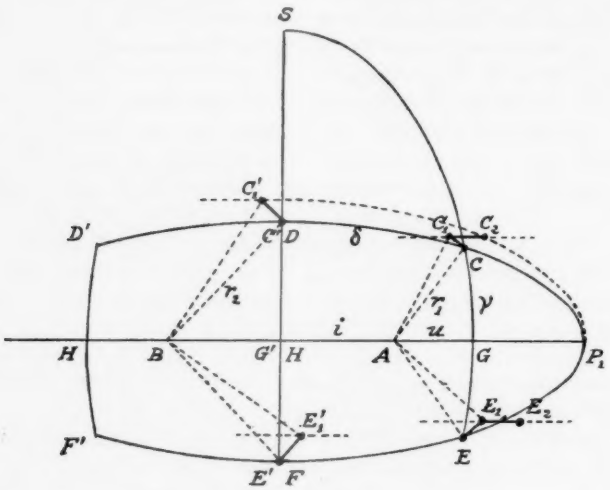

FIG. 4.

each other, is given below. Fig. 4 is fig. 14 of the previous paper, reproduced for easy reference.

(*a*) Set two points near the centres of plates *A*, *B* in correspondence by means of the difference screw between the two frames.

(*b*) Set a horizontal diameter *GH* in correspondence with *G'H'* by rotating either of the position circles.

(*c*) Make the polar angle *CE* equal to the polar angle *C'E'* by rotating plate *A* round its declination axis. It will be seen that for small errors in the assumed position angles of the plates, $\Delta\lambda(C)=\Delta\lambda(E)$ and $\Delta\lambda(C')=\Delta\lambda(E')$, so that a near approximation to the declination of plate *A* is at once obtained. The adjustment is effected by making approximately equal the discrepancies in correspondence between *C* and *C'* and *E* and *E'* by means of the difference screw, then altering the declination of plate *A* to make *CE*=*C'E'* in polar angle, repeating with the difference screw and the declination until *CC'* and *EE'* are simultaneously in correspondence.

(*d*) Bring again points near the centres of plates *A* and *B* in correspondence by means of the difference screw and repeat (*c*) for the second plate.

(*e*) Set again to centres. *C* and *C'* are then brought into correspondence by equal rotations of the position circles. *E* and *E'* should then also be in correspondence, but there may be a small residual error which is removed by going over (*a*) . . . (*e*) a second time. In making adjustment (*e*) an indication of the amount of rotation that should be given to the circles is afforded by the known variation in polar bearing for change in position angle.

If *C* and *E* are taken at equal polar distances, the mirrors will remain in one position while observing *C* and *E* and *C'* and *E'*, so that any error, due to imperfection of the slides, in the correspondence of *C* and *C'* is reproduced in the correspondence of *E* and *E'*, and does not affect the setting in declination, since this depends on the equality in polar angle of *CE* and *C'E'*. The errors in the slides will then affect position angles only, and merely by an amount which is of the same order as the want of straightness of the slides.

Witte Els Bosch,
September 1927.

Addendum. *October* 1927.—The transfer of the vertical may be performed, as we have seen, by instrumental means. The determination of the directions of the air bases can, in like manner, be simplified by taking advantage of a property of the instrument for effecting part of the solution.

Given two plates in correspondence, and their vertical points *Z* brought into the measuring plane of the instrument, the trace, on either plate, of the vertical plane containing the air base is the intersection of the plate by the measuring plane. The bearing on the plate of this trace may be read directly on the position circle with the help of a marker similar to those used for the transfer of the vertical, except that it has only one slide. The marker is clamped on the side of the position circle opposite to *Z*, and its mark adjusted upon the trace of the vertical plane, that is in correspondence with *Z*. Set next the declination circle to its zero, and the plate normal of the photogoniometer perpendicular to the polar axis. Then bring again the two marks into correspondence by rotating the position circle. The reading on the circle will be the bearing of the parallel through the principal point.

Fig. 5 represents the orthographic projection of a pair of linked plates upon a horizontal plane. *Z* is the vertical point common to the two plates. The bearings on the plates of R_1S_1 and R_2S_2, parallel through the principal points to the traces P_1Z and P_2Z of the vertical planes containing the air bases, are now known. The inclinations of the plates and the bearings on

the plates of the traces M_1N_1 and M_2N_2 of the horizontal planes through B_1 and A_2 are also known from the instrumental transfer of the vertical.

If a line, lying in a plane of inclination i, makes an angle θ with any horizontal line in the same plane, the corresponding angle θ' between the

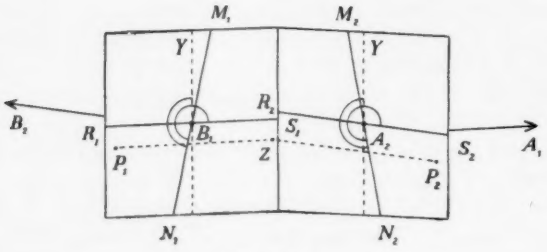

FIG. 5.

orthographic projections of the two lines upon a horizontal plane will be given by

$$\tan \theta' = \tan \theta \cos i.$$

This relation determines the projected angles N_1B_1Y and $N_1B_1S_1$ for the one plate, and the projected angles N_2A_2Y and $N_2A_2S_2$ for the other, all reckoned clockwise from N. The respective differences between these angles give the projected angles YB_1S_1 and YA_2S_2. B_1Y and A_2Y being the y-axes of the plates, are parallel. The difference between the two projected angles YB_1S_1 and YA_2S_2 will therefore be the same as the difference in horizontal direction of the two bases ZA_1 and B_2Z.

The different steps of the simplified solution which has resulted from a more complete appreciation of the remarkable properties of the instrument may now be recapitulated.

1. Starting from an assumed value of the length of the first base, the inclined lengths of the other bases are derived from the vertical triangulation.

2. The relative inclinations of the bases are obtained directly by noting, for each pair of plates, the angle which the vertical line at one of the stations makes with the polar axis. The inclination angle for computation is $i+\frac{C}{2}$ where C is the curvature and i negative for depression.

3. The relative horizontal directions of the bases are determined by the method just described.

4. Assuming the inclination of the first base to be zero, the co-ordinates x, y, and h of each air station are computed, and also, on the same system, those of the terminal ground stations. The resulting length, direction,

and inclination of the line joining the two ground stations will then give, by comparison with the corresponding known values, a proportional correction to the lengths of all the bases, and constant corrections to their directions and inclinations.

5. Proceed similarly (1 to 4) for the strips along the other two sides of the primary triangle.

6. Determine θ and θ', at the three junctions of the strips, by the method described in the second paper.

7. Apply the corrections for twist $\Delta\lambda_m = \frac{m}{n}\Delta\lambda$ to the polar angles of the plates given by the readings on the direction circle of the successive vertical points. $\Delta\lambda$ is the difference between the initial and terminal values of θ for each strip.

The terminal connections considered have been those for a triangle. Exactly the same procedure applies to control stations arranged to form a rectangular grid to be filled in with single strips in one direction and overlapping parallel strips in the other. The parallel strips may have a 50 per cent. overlap to provide against gaps that might otherwise result from defective or missed plates, or from deviation of the line of flight. The length of the strips is limited by the condition that sufficient accuracy must be preserved to ensure a satisfactory graphical fit of the details in the overlaps. This is a matter that must be left for practical experiment.

THE PRINCIPAL POINT AND PRINCIPAL DISTANCE IN PHOTOGRAMMETRY.

By H. G. Fourcade.

(With four Text-figures.)

The *principal point* of a plate is the foot of the perpendicular from the back nodal point of the lens to the plate. It was at first thought that the position of this point could be determined by a reflection method. In a camera furnished with a réseau plate, the lens was removed and a level, or theodolite, fitted with a reflecting eye-piece, was collimated with the mirror formed by the silvered-back surface of the réseau plate. The lens being then replaced, it was adjusted, by means of cross-slides on its mount, until the cross-wires in the telescope were found to bisect the central intersection of the réseau lines.* In a camera not provided with a réseau, a similar procedure could be followed by substituting for the réseau a silvered plane mirror on which are ruled a horizontal and a vertical line forming a cross, the ends of which are set in correspondence with the reference marks of the camera.

An equivalent method has been proposed by Col. E. H. Hills.† A clear glass plate having been placed in the focal plane of the camera, the camera is set, lens downwards, over a dish of mercury and levelled so as to make the glass plate horizontal. The principal point is then assumed to be the point at which a mark on the plate coincides with its image reflected from the surface of the mercury.

The principal point being the foot C of the perpendicular from the back nodal point O of the lens to the plate, it follows, geometrically, that if two points, A and B on the plate, are equally distant from C, the angles AOC and BOC must be equal.

An investigation, in the course of which the distortion of a photographic lens was determined with great precision,‡ disclosed the fact that this geometrical centre C does not coincide with the apparent principal point

* "On a Stereoscopic Method of Photographic Surveying," S. Afr. Phil. Soc., Oct. 2, 1901.

† G. T. M'Caw, The Principal Point and Principal Distance. War Office, 1921.

‡ Trans. Roy. Soc. S. Afr., vol. xiv, pt. 1, 1926, p. 32.

C' given by the reflection method, that is the point on the plate to which converge parallel rays entering the lens perpendicularly to the plate. The angle COC', at the back nodal point, between C and C', may be called the deviation of the lens. This angle, being always very small, will be practically independent of the exact distance of the back nodal point from the plate.

In the lens examined, the horizontal and vertical components of the deviation were

$$\alpha = +4' 53''{\cdot}5$$
$$\beta = -6' 26''{\cdot}1,$$

the corresponding difference in the plate co-ordinates of C and C' being

$$\Delta x = +0{\cdot}199 \text{ mm.}$$
$$\Delta z = -0{\cdot}261 \quad ,,$$

The deviation observed was attributed to errors in the centering of the system of lenses,* but it may also have been due in part to imperfect "squaring on" of the lens relatively to the réseau plate, and to want of parallelism of the two surfaces of the plate. Exact parallelism being of no importance for the projection of the réseau, the plate was not tested in this respect before assembling the parts, and could not now be tested without removal from the camera and upsetting of its adjustments.

The accuracy of position of the principal point determined by reflection not being verifiable otherwise than by agreement with the geometrical centre resulting from measurements, it is natural to adopt the latter in preference to the former; but the reflection method is still very useful for obtaining a first approximation, which, being accurate to a fraction of a millimetre, renders very simple the further determination of the camera constants.

Referring the plate measures to the true principal point, the correction for distortion to the distance r of a point on the plate from the principal point was found to be

$$\Delta r = -3{\cdot}6902r^2 + 0{\cdot}04880r^3 - 0{\cdot}05450r^4$$
(Δr in microns, r in cm.),

with a probable error, attributable to uncorrected distortion, of $\pm 0{\cdot}5\ \mu$,

* A compound lens has as many optical axes as there are separate lenses in the system. It is correctly centered when the centres of curvature of all the surfaces are in a straight line. This is a difficult adjustment to make with small lenses of high curvature. In the lens referred to, the radius of curvature of the surfaces common to the first two lenses is only 6·61 mm. A slip of 0·02 mm. in cementing the two surfaces, or in centering the second lens when grinding its periphery, will tilt the second axis by 10′, which is sufficient to cause a sensible difference between the geometrical centre and the centre determined by reflection.

equivalent to an angular error of under one second. The *principal* distance for the same lens, that is the distance of the principal point from the back nodal point of the lens for rays making a small angle with the optical axis, was 139·60 mm.

The methods used for those determinations, of which an account has been given in the author's 1926 paper,* are too laborious for practical application. The investigation yielded, however, two important results which will allow of a much simpler procedure being followed. The first result is that the distortion of a good lens is accurately symmetrical about the true principal point. This point then becomes the point on the plate, equal distances from which subtend equal angles. The second result, useful for the determination of the principal distance, is that the expression for the distortion may be simplified. In solving the equations determining the coefficients of r^2, r^3, and r^4, it was noticed that the distortion could have been represented almost equally well by terms in r^2 and r^4 alone. For equal values, when $r=5{\cdot}5$ and $r=4{\cdot}0$, a two-term expression becomes

$$\Delta r = -3{\cdot}5772r^2 - 0{\cdot}04936r^4,$$

comparative values, to the nearest last place, being

r cm.	3-term expression.	2-term expression.
6·0	−192·9 μ	−192·8 μ
5·0	120·2	120·3
4·0	69·9	69·9
3·0	36·3	36·2
2·0	15·2	15·1
1·0	3·7	3·7
0·0	0·0	0·0

Two-term expressions, in r^2 and r^3, or r^3 and r^5, do not agree nearly so well.

Determination of Principal Point.—When the camera is not fitted with a réseau, plate measures cannot be used for the purpose because, as was shown in the 1926 paper cited,† the curvature of commercial plates is too great to allow of any accurate result being arrived at. For the photographic plate a plane glass scale is therefore substituted. The scale consists of a vertical and a horizontal line intersecting at the centre, both divided in millimetres except near the centre. A circular patch is silvered around the centre mark, which is left clear. The silvering may be varnished for protection.

* *Loc. cit.* (1926), p. 32.

† *Loc. cit.*, p. 31.

Using a suitable magnifier, the ends of the cross-lines are first set in coincidence with the reference marks of the camera. The best form for these is that of a small glass disk, mounted in a cell fixed to the camera side and ruled with a pair of parallel lines. One of the marks must be adjustable, and the front surface of all four ground accurately to a common plane which is the focal plane.* Three setting screws must be provided in the camera frame; also opposing springs. The lens is next removed and a level, or theodolite, fitted with a reflecting eye-piece, collimated with the central mirror. The lens being replaced, it is adjusted by means of the cross-slides on its mount until the centre mark of the scale is bisected by the cross-wires.

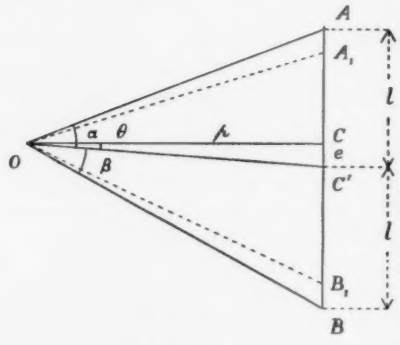

FIG. 1.

In fig. 1, O is the back nodal point of the lens, C' the centre mark of the scale, C the true principal point at a distance e from C', and A, B two corresponding divisions at a distance l from C'. A ray OA_1 entering the lens at an angle α with OC' and passing through O is deviated by distortion to OA. The correction for distortion being of the form ar^2+br^4, we have

$$l-e+a(l-e)^2+b(l-e)^4=p\tan(\alpha-\theta)$$
$$l+e+a(l+e)^2+b(l+e)^4=p\tan(\beta+\theta).$$

e being small, we get by addition, for three values of l,

$$l_1+al_1^2+bl_1^4=p\sin(\alpha_1+\beta_1)/2\cos\alpha_1\cos\beta_1$$
$$l_2+al_2^2+bl_2^4=p\sin(\alpha_2+\beta_2)/2\cos\alpha_2\cos\beta_2$$
$$l_3+al_3^2+bl_3^4=p\sin(\alpha_3+\beta_3)/2\cos\alpha_3\cos\beta_3,$$

whence a, b, and p are determined. If the unit is a centimetre, l^2 and l^4 should be divided by 10,000 to make the equations give coefficients, a and b expressing the distortion in microns for l in centimetres, and also to render the arithmetical work more manageable.

The equations are in convenient form for least-square solution when more than three pairs of angles are observed. A simpler method of reduction

* Four stops are better than three, because a pair of horizontal and a pair of vertical marks are essential. A slight pressure will bring the photographic plate into contact with all the stops, and the resulting small deformation is reproduced in any measuring instrument provided with similar stops.

becomes applicable if three equal groups of consecutive scale divisions are used. Equations having been formed separately for each pair of divisions, a mean equation is substituted for each group, with little loss of accuracy in the results.

From each pair of equations we also get by subtraction and reduction

$$e=p\frac{\tan\alpha-\tan\beta}{\tan^2\alpha+\tan^2\beta}=p\frac{\alpha-\beta}{2\sin^2\alpha}$$

with relative weight $\sin^4\alpha$, from which a weighted mean for e may be derived. e must be computed for both a horizontal and a vertical diameter of the plate. The pair of values give the co-ordinates of C referred to C'. To make C coincide with C' the lens is displaced by these amounts in its cross-slides.

The best values for l_2 and l_3 are $l_2=l_1\sqrt{\frac{2}{3}}=0{\cdot}8\ l_1$ and $l_3=l\sqrt{\frac{1}{3}}=0{\cdot}58\ l_1$, l_1 being taken as large as practicable. With a plate 4×5 inches, if l_1 is made 60 mm., the best other divisions to observe will be in the neighbourhood of $l_2=48$ mm. and $l_3=35$ mm.

Measurement of the Angles.—The following is a convenient arrangement for measuring the angles α and β. A pair of double reflection prisms are mounted in a box, one of the prisms being movable in the direction of the other. Each of the prisms deviates the rays nominally 90°. The total deviation of a ray through both prisms will be a small angle ω, usually not exceeding 2′ and remaining constant independently of the separation of the prisms. In fig. 2 (I), O is the front nodal point of the camera lens. A theodolite at T is collimated with the centre mark C' of the scale. The prism box being interposed, the telescope of the theodolite may, with a proper separation of the prisms, be pointed towards any division A of the scale, and the angle $\alpha+\omega$ read on the circle. If now the box is turned round 180° as in fig. 2 (II), keeping the same side above, the reading on the circle will give $\alpha-\omega$, and the mean of the first and second readings, α freed from ω. The box being next inverted by turning it 180° round its longer axis, as in fig. 2 (III), the telescope may be pointed towards the division B_1 corresponding to A, and the angle $\beta+\omega$ read. Finally, the angle $\beta-\omega$ is observed after turning the box 180° round in a horizontal plane, as in fig. 2 (IV). It is desirable to keep the line of collimation passing, in all the positions, near the front nodal point of the lens. For this purpose there is provided a millimetre scale on the box, which indicates the lateral displacement of a ray by the prisms. The distance OT between the vertical axis of the theodolite and the front nodal point of the lens having been measured, the required separation of the prisms for observing a division A at a distance l from C' will be OT sin α, α being given sufficiently by tan $\alpha=l/f$. If the telescope is now set at approximately α from the direction of C' the

interposition of the prisms will bring A into the field and the angle $\alpha+\omega$ may be read on the circle. Supposing the theodolite to be placed 18 inches from the camera lens, the maximum separation of the prisms for a lens of 6-inch focus and a plate 4×5 inches, will be about $7\frac{1}{2}$ inches. Angles

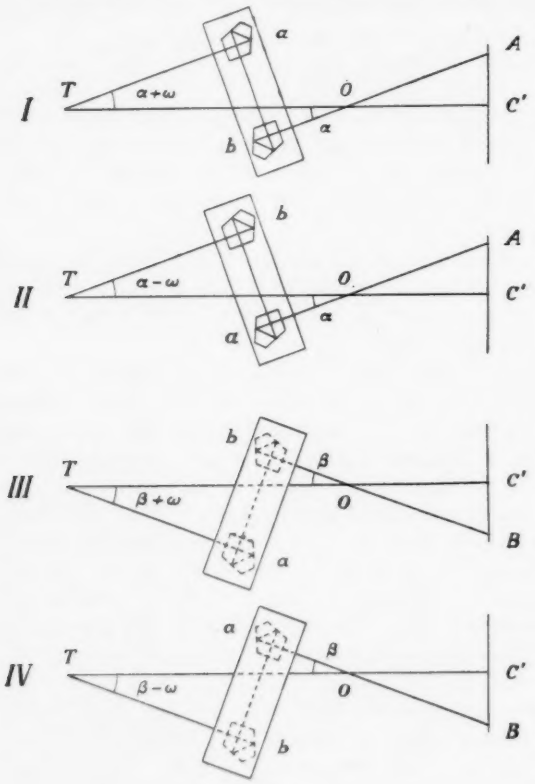

FIG. 2.

smaller than 5° will not be measurable with the device, but this is no drawback, larger angles being preferable for all the observations.

To determine the vertical co-ordinate of C, the observations are repeated, in a vertical plane, for a single pair of angles, the best value being obtained when l is 0·8 or 0·7 of the horizontal diameter of the plate.

Cheap prisms are to be avoided as they have curved faces and show when interposed a difference of focus in the collimation, and a deviation varying sensibly with their position. The exact angles of the prisms is

unimportant, but their faces must be plane. Even with good prisms it is advisable to always reverse the box with fair symmetry relatively to the line *OT*.

Second Method.—An alternative method may be devised in which only one prism is employed. The prism is placed on the circumference of the circle, of which the diameter is the line joining the front nodal point *O* of the lens and the vertical axis *T* of the theodolite (fig. 3). By moving the prism along the circumference any division can be observed. As with the other method, it is desirable to centre the prism relatively to *O* and *T*. Its position is correct when the point at which the perpendiculars on the centres of the front faces meet is on the circle. This condition may be secured by pivoting the prism on a rule which slides through a pivoted support, placing the pivot of this support at a point *P* midway between *O* and *T* and separating the pivots to the distance *OP*.

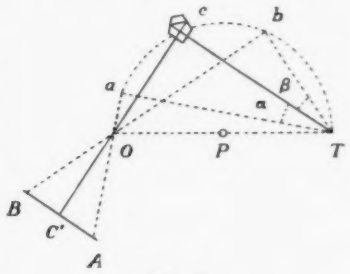

FIG. 3.

Adjustment of Double Cameras.—The double camera is fitted with a pair of levels at right angles, and its lens mounts are capable of rotation round their axes in order to make the deviations of the lenses horizontal. If e and e' are the horizontal and vertical components of the deviation, the amount of rotation needed will be given by $\tan \omega = e/e'$. A rim graduated in degrees serves for the setting.

(*a*) In each camera a plane glass scale of the construction already described is substituted for a plate. The double camera is then placed on a support which may be levelled.

(*b*) Remove the camera lenses and level the camera until both mirrors of the glass scales are in vertical planes, as determined by reflection in a pair of survey levels provided with reflecting eye-pieces. Adjust the camera levels to bring the bubbles to the centres of their runs.

(*c*) Replace the lenses, rotating each mount to its correct setting for deviation ω, ω having been independently determined, and adjust the horizontal reference marks by collimating each in succession with one of the survey levels when the bubbles of the camera levels are at the centres of their runs.

(*d*) Remove the camera lenses, level the camera, and collimate again the survey levels with the mirrors.

(*e*) Replace one of the lenses and adjust the scale to bring its central cross in collimation with the corresponding level and its horizontal line

in register with the horizontal reference marks of the camera. Verify (*d*) for the other camera in case of disturbance when the lens was replaced. Adjust the two vertical reference marks to agree with the vertical line of the scale.

(*f*) Repeat (*e*) for the other camera, except that the principal point of the first camera may now serve as a R.O. for the second.

(*g*) Determine the principal point of each camera in the manner described above and adjust to agreement with the central cross, by means of the horizontal slides of the lens mounts.

(*h*) Collimate the survey levels with the two central crosses. Remove the camera and, at the point of intersection of the optical axes, substitute a theodolite, with which measure the angle between the collimation lines of the two levels, which angle will be the angle between the normals of the two plates.

Calibration of Stereogoniometer.—In the author's stereogoniometer, the plates having to be rotated, the principal point must necessarily first be set to coincide with the centre of rotation of the position circle. The reference marks are next adjusted to register with the ends of the cross of the glass scale. The angles α and β can then be measured directly in the instrument, both in a horizontal and in a vertical diameter. The horizontal and vertical values of e having been computed, the lens is displaced in its cross-slides by corresponding amounts. The four lenses intended to be used in the camera and the photogoniometers agree to within $\frac{1}{3}$ mm. in focal length, so that it is possible to set, by means of a correction collar, the lenses of the photogoniometer to the exact principal distance of the lenses in the cameras, without sensibly affecting the definition. This condition of equal principal distances is essential for the correspondence of the camera angles with those of the photogoniometers.

The lenses being similar and of equal focal length should have equal distortion, which is therefore eliminated. When the distortions of the corresponding lenses are not exactly equal, the difference in distortion may be represented by a parabola, and its mean magnitude will be least, over a diameter of the plate, if we choose values for the principal distances which make the distortion zero when $l = \frac{3}{4}r$. The corresponding value of l, for a circle of radius r, is $\frac{3}{4}r$.

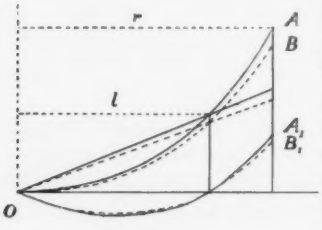

FIG. 4.

In fig. 4, if A is the curve of distortion for lens A, and B the curve for lens B, A_1 and B_1 will be the respective curves when the distortion is made zero at 0·75 r.

Measure in the camera the angles α_1 and β_1 between the centre of the scale and divisions at $l=0{\cdot}8r$, r being the semi-diameter of the plate. Measure also the corresponding angles α_2 and β_2 in the photogoniometer. The principal distances which will make the distortion zero at l are given by

$$p_1=\frac{l\sin(\alpha_1+\beta_1)}{2\cos\alpha_1\cos\beta_1} \qquad p_2=\frac{l\sin(\alpha_2+\beta_2)}{2\cos\alpha_2\cos\beta_2},$$

and the horizontal co-ordinates of the principal points by

$$e_1=p_1\frac{\alpha_1-\beta_1}{2\sin^2\alpha} \qquad e_2=p_2\frac{\alpha_2-\beta_2}{2\sin^2\alpha}.$$

Using a vertical diameter, determine also e'_2, the vertical co-ordinate of the principal point of the photogoniometer. Adjust e_1 by means of the horizontal slide of the camera lens, this being adjustment (q) of the preceding section, and adjust e_2 and e'_2 by means of the cross-slides of the photogoniometer lens. Finally, add the difference p_1-p_2 to p_2 by means of the correction collar on the photogoniometer lens.

Previous Methods.—Earlier methods for the determination of the principal point and principal distance are those of Deville,* Steiner,† Jordan,‡ Schell,§ and Hugershoff and Cranz.‖ A full account of the last four, with modifications and worked-out numerical examples, is given by Captain M'Caw, from whose paper, previously cited, several of the references are taken. Deville's method consisted in tracing the horizon line on the plate first with the camera in its normal position, and then on its side, the plate being in both cases set in a vertical plane. The intersection of the two lines was assumed to be the principal point. The principal distance is then obtainable from plate measures. Steiner and Jordan determine the constants from plate measures for three known points and ignore distortion. Schell and Hugershoff use a greater number of points than three, and treating the distortion as an accidental error find the principal distance and principal point by a least-square adjustment of plate measures. These methods are all faulty because they depend on plate measures taken without reference to a réseau and the distortion is either ignored or treated as an accidental error, with the consequence that the principal distance has no definite meaning and will vary with the angular field included in the measures.

* E. Deville, Photographic Surveying, Ottawa, 1895, p. 142.

† F. Steiner, Die Photographie im Dienste des Ingenieurs, Vienna, 1891–93, p. 84.

‡ W. Jordan, Handbuch der Vermessungskunde, 8th ed., Stuttgart, 1914, vol. ii, p. 844.

§ Hartner and Doležăl, Hand- und Lehrbuch der niederen Geodäsie, Vienna, 1905.

‖ R. Hugershoff and H. Cranz, Grundlagen der Photogrammetrie aus Luftfahrzeugen, Stuttgart, 1919, p. 11.

In another method, due to Commander Baker,* the image of a slit in a collimator is photographed on the plate, directly and after interposing two constant deviation prisms, one of which being reversed gives equal right and left angles. The distortion, expressed by two terms in x^3 and x^5, is included in the equations, but an additional equation resulting from another pair of measures should be added to make the equations determinate. The drawbacks of the method are that the constants are derived from plate measures not controlled by a réseau and that a separate prism is required for each pair of angles measured. Moreover these angles, which may not be the best for the field of a particular camera, or in a best conditioned ratio, cannot be altered without changing the set of prisms. Nevertheless, the principle of obtaining equal angles by the reversal of a prism is excellent, and has been made use of in one of the methods of the present paper for the converse purpose of eliminating the deviation introduced by a prism.

Witte Els Bosch,
September 1927.

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* T. Y. Baker, Calibration of Cameras, Admiralty Research Laboratory, 1925.

ON A *MYOSURUS* FROM SOUTH AFRICA, WITH SOME NOTES ON *MARSILIA MACROCARPA*.

By D. Thoday and M. A. Pocock.

(With Plate I and three Text-figures.)

In October of 1922 a few plants of a *Myosurus* were collected by one of us near Zandvliet Farm, about twelve miles to the south of Triangle Station, in the Worcester Division of the Cape, and just north of the Table Mountain Sandstone crest of the Wagenboomsbergen. The find is of special interest, firstly because the genus has not previously been recorded from Southern Africa, secondly because its habitat is restricted and its associates characteristic.

The nearest records for the genus are from the Mediterranean coast region of North Africa: Huth * gives *Myosurus minimus* and *M. breviscapus* as occurring there.

From the Southern Hemisphere only two of the seven species recognised by Huth have been recorded, viz. *M. minimus* (var. *australis*) from Australia, *M. aristatus* from New Zealand and South America. The other four species are all restricted to North America. Two new species have since been described from South America, five from North America, and one from Europe (Greece).

The Zandvliet specimens were collected from a shallow, grassy sluit overshadowed by bushes a couple of feet high. The plants were in flower, growing in large numbers in the moist bottom of the sluit and spreading up the bank among the bushes.

A mile or two from this spot a small, dry pan had already attracted our attention owing to the abundance of a small *Marsilia*, answering to the description of *M. macrocarpa* var. *Burchellii* Sim, which covered fairly uniformly the apparently dry and sun-baked soil. Photograph 1 shows the striking contrast between the smooth pan, with its sward of dwarf fruiting *Marsilia* and the surrounding veld, where over large areas the shrubby viscid Karroo Daisy, *Dimorphotheca cuneata*, was the predominating species.†

* Huth, E., Revision der kleineren Ranunculaceen-Gattungen *Myosurus*, etc. Engler's Bot. Jahrb., vol. xvi, 1893, p. 278.

† The grey bushes, taller and more conspicuous in the photograph, are probably Rhenosterbosch, *Elytropappus rhinocerotis*.

Photograph 2 shows a portion towards the margin of the sward in nearer view. The hairy sporocarps of the *Marsilia* are conspicuously abundant. Here and there, round the rock, though not recognised at the time, are plants of *Myosurus* with their characteristic fruiting " spikes " and narrow leaves. The sporocarps on dry specimens of *Marsilia* collected from the pan measure about 2½ to 3 mm. in diameter, so that the spikes in the photograph are 10 to 15 mm. long.

On a previous expedition, in September of 1921, one of us had already found the same form of *Marsilia* growing in a small pan a mile or two to the north-west of Touws River Station. The pan had attracted attention from a kopje, perhaps half a mile away, as a yellow-green spot looking like a pond covered with duckweed in the midst of the karroid plain. Actually it owed its appearance to the yellow-green leaves of *Hypoxis aquatica*, flowering inconspicuously, which was dominant except at the margin and in small patches slightly raised above the general level. Here *Marsilia* was the most abundant constituent of a close, darker green turf of dwarf plants. A small portion of this turf was preserved in spirit for later examination. After the Zandvliet discovery this material was examined and three minute plants of *Myosurus* were found. The largest of them was only about 16 mm. in length from the base of the stem to the tip of the solitary immature fruiting spike. Other more conspicuous constituents, though also dwarf, were a species of *Limosella*, probably *L. aquatica* Linn. (var. *tenuifolia*) and a tiny *Crassula* in fruit (? *C. natans*).

For *Marsilia*, Touws River was much farther west than any locality previously recorded; for *Myosurus*, it is the second known locality in South Africa.

Identification.

It is unfortunate that none of the specimens bear mature fruits, for the species of *Myosurus* have been distinguished chiefly by the characters of the achenes. Some degree of uncertainty must therefore attach to the identification.

The one dried plant (*M. A. Pocock* 999—Zandvliet Farm, Triangle District, October 1922), which is in flower, has been compared at Kew. Two specimens from Zandvliet preserved in formalin, and the minute spirit specimens from Touws River, have been compared with plants of *Myosurus minimus* grown in the Cambridge University Botanic Garden, for which we are indebted to the Director, Dr. Humphrey Carter. The South African plants might well be immature plants of the British species, grown under relatively unfavourable conditions of strong insolation and a scantier water supply, becoming more quickly exhausted. No evidence has been found which would appear to justify separation from *Myosurus minimus*. The

sepal spurs are short and blunt (text-fig. 1); but Asa Gray * found the spurs liable to vary within a single species, and they cannot therefore be trusted (see *loc. cit.*, under *M. alopecuroides*). All the South African specimens bore only a single flower; but so did many of the less robust of the Cambridge specimens. The oldest carpels of the Touws River specimens (text-fig. 2) matched quite well carpels of medium age from Cambridge.

FIG. 1.

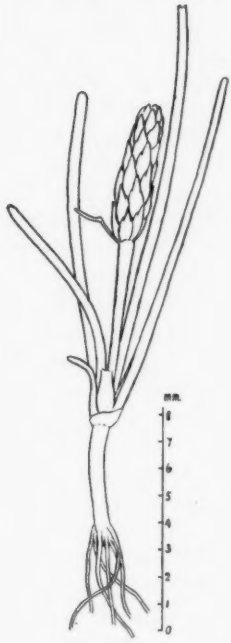


FIG. 2.

The broad smooth back of the Carpel, shown also in the specimens in Photograph 2, is a point of correspondence.

As, however, one of the spikes in the photograph has a few of the carpels with slightly spreading, or at least not closely adpressed, beaks, it may be well to consider other possibilities, for Huth separates *M. minimus* from all the other species on account of the straight beak of the carpel adpressed to the fruiting spike.

After going through the specimens of the genus at Kew, one is left with the impression that the characters used by Huth to differentiate between the species are not all valid. For example, specimens of *M. minimus*

* Asa Gray, Notes on *Myosurus*. Bull. Torrey Bot. Club, vol. xiii, 1886.

appear sometimes to have the carpel beaks not closely adpressed (*e.g. B. Balansa* 574 Algeria in Herb. Kew.), while *Citarda* 250 (in Herb. Kew.), quoted by Huth as *breviscapus* var. *madonensis*, has short beaks slightly divaricate in some spikes, but in a few practically straight.

Taking his classification, however, at its face value, and passing over *M. minimus*, there are first the alternatives keeled *or* thickened margins to the outer face of the carpels. Of the latter character there is no sign in the South African specimens ; the species *M. alopecuroides* and *M. cupulatus*, moreover, appear to be quite distinctive forms.

Of the other group only *M. breviscapus* and *M. aristatus* need be considered. *M. aristatus* is distinguished as having a spreading beak as long as the carpel. Young flowers of *aristatus* and *minimus* are often apparently indistinguishable ; but our older specimens, particularly those from Touws River and those photographed, should show clearer signs of the characteristic beak developing if the mature achene were of the *aristatus* type. The rather broad back of the carpel, without keel, is in itself strongly against any comparison with *aristatus*.

M. breviscapus is described as having a shorter beak, apparently less divergent from the spike than that of *aristatus*. The specimen already referred to above (*Citarda* 250) shows this character to be variable. The shortness of the scape (fruit stalk) in proportion to the spike, to which the specific name refers, can hardly be given much weight, as this character is also variable. In the specimens of *M. minimus* obtained from Cambridge, all from one culture, were two plants with scapes distinctly shorter than the mature spikes, while most of the others had scapes more or less longer than spikes. A comparison of our South African plants makes it probable that the relative length of scape and spike will depend very largely on the conditions existing respectively up to and after pollination. In the specimens photographed (Photograph 2), in the dry pan, the scapes are short. In the flowering plants from a moister situation, the scapes are already longer in proportion to the leaves. On these grounds it is not clear that *M. breviscapus* is a good species.

We conclude, therefore, that the South African plants probably belong to *Myosurus minimus*, but that this determination requires confirmation. For this purpose further material including ripe fruits is essential.

Geographical Distribution of the Genus *Myosurus*.

We are indebted to Mr. J. Hutchinson of Kew for the accompanying map (text-fig. 3), which indicates clearly enough the importance of the discovery from a geographical point of view. If the determination here given of the species of the South African *Myosurus* is correct, *M. minimus* has been

recorded from all the main areas of distribution of the genus except South America and New Zealand. Bentham and Hooker's British Flora refers to it as introduced into North America, but its very wide distribution there makes this view seem highly improbable. American floras accept the species as indigenous.* Whether Bentham's suggestion (Flora *Australensis*),

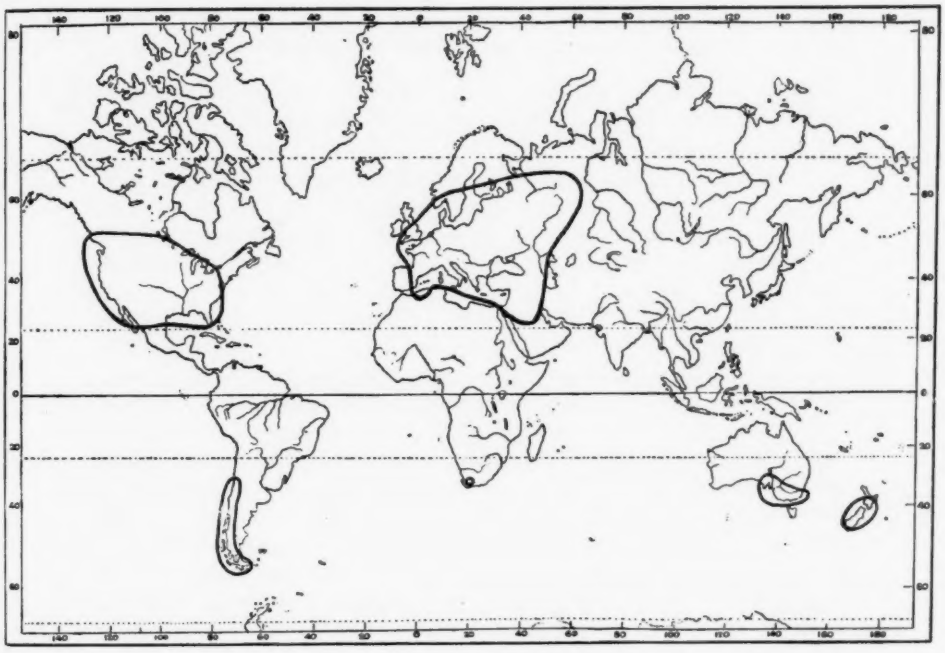


FIG. 3.—Range of genus *Myosurus*.

that it may have been introduced into Australia, is any better founded we cannot say, though there also it appears to be widely distributed in the South and East. Certainly in South Africa the remoteness of the localities (or at least of the Zandvliet Station), the extreme localisation and discontinuity of its habitat, and the unquestionably indigenous character of its associates indicate very forcibly that it is native there.

The only other species with a wide range is *Myosurus aristatus*. This has been recorded from North and South America and also from New

* Britton, Manual of the Flora of the Northern States and Canada; Howell, Flora of North-West America.

Zealand; but according to Cheeseman * there are grave doubts as to the identity of the New Zealand plants with the American species. The wide distribution of *M. minimus* suggests that it is the oldest species. Since the bulk of the recorded species are North and South American endemics, we may perhaps look to America as the original home of the genus.

Further Observations on *Marsilia macrocarpa.*

Since the discovery of *Myosurus*, *Marsilia* has been found in a number of other localities, but so far without *Myosurus*, although search was made for it in every case.

1. Bloemfontein, June 1923. In bare, open country to the south-west of the town, roundish patches of green caught the eye. On examination these proved to be covered with dwarf plants of *Marsilia macrocarpa* of the type of var. *Burchellii*, and in the rainy season had evidently been shallow pans of water.

2. Johannesburg, July-August 1923, Boksburg Lake. Isolated plants of *Marsilia* were fairly common at the eastern end of the lake along the north bank. Just above the extreme eastern end of the main lake is another piece of water, and here *Marsilia* grew in great abundance, covering perhaps half an acre, both in the water and on dry land. In the water the plants were mainly of the normal *M. macrocarpa* type with large entire leaflets on long petioles. On the driest ground they were mostly small, with indented leaves of the var. *Burchellii* type. Connecting the two extremes was a complete range of intermediate forms. Sometimes one and the same trailing stem bore several forms of leaf. Whether the sporocarp showed a similar range of variation could not be determined at the time. (The Boksburg lakes have been formed by damming up a series of small streams and pools, and are to this extent artificial.)

3. Grahamstown, winter of 1924. *Marsilia* grew in and around several small pools (in holes where material had been dug out to mend the road) along the Cradock road, both in mud and actually in water. This was mainly of the small-leaved type, but when grown in a shady tank at the Rhodes University College produced long-stalked leaves with large leaflets like typical *M. macrocarpa*.

4. Oudtshoorn, November 1924. The overflow from a dam above the town followed a shallow furrow as a small stream which had at some time previously overflowed and formed a patch of swampy ground. Here were very dry-looking dwarf plants of *Marsilia macrocarpa* var. *Burchellii* associated with a small *Crassula*.

* Cheeseman, T. F., Manual of the New Zealand Flora, 1925.

5. Rhodesia and Angola.

(*a*) At the Victoria Falls, April 1925, large-leaved *M. macrocarpa* was growing in water in a pool (which had obviously been dug out) near the railway, between the hotel and the Rain Forest.

(*b*) On the Zambesi, April-May 1925, *Marsilia* was abundant in many parts of the vlei lands, often in water several feet deep. As the floods were out, all this country was inundated, but in the dry season many parts evidently dry up more or less completely, leaving isolated pools or marshy patches at intervals. *Marsilia* grew particularly round the edges of such pools, in places along the banks of the river itself and in shallow vlei lands.

It is clear from these observations, made by one of us under conditions which precluded following them up immediately, that *Marsilia macrocarpa* is very widely distributed; that it often occurs in spots that are moist or wet for a time, but dry out sooner or later more or less completely; and that it is very variable. Though the evidence is not conclusive, sporocarps not having been available in every case, it suggests very strongly that the series of forms to which varietal rank has been assigned may merely represent the response of a single species to a rather wide range of environmental conditions within what is nevertheless a well-defined type of habitat. Further, more extensive and intensive study may be expected to throw light on this and other problems suggested by these observations. Two may be referred to in conclusion. One is the means of dispersal of the *Marsilia* and other plants associated with it, including *Myosurus*.

The sharp discontinuity, small area, and wide separation of many of the habitats, and, further, the recent and artificial character of the water-holes (*e.g.* those along the Cradock road near Grahamstown and that near the Victoria Falls) all suggest that active dispersal occurs.

Birds may be the agents: many species of water-birds, both divers and waders, are common to the vlei lands of the Zambesi in Northern Rhodesia and to those of the Cape Flats and the Cape Province generally. The wide range of these birds should be conducive to the wide distribution of water-plants. In the case of *Marsilia*, if, as appears probable, the so-called varieties prove to be merely ecological forms of the one species, the vlei lands of the upper Zambesi may be regarded as a huge storage reservoir, for *Marsilia macrocarpa* occurs there in very great quantities.

The other problem is the limited range of *Myosurus*, which contrasts apparently so sharply with the wide range of *Marsilia*. How is this to be accounted for? The whole flora of this type of habitat would be well worth special study from this point of view. In general, the number of species appears to be small in the upland pans. The vleis of the Cape

Peninsula, and of the S.W. Coast belt generally, even those which dry up in the summer, are rich by contrast. Geographical and ecological problems of considerable interest would be bound to emerge from a detailed comparison.

Summary.

The discovery is recorded of a species of *Myosurus*, a genus new to South Africa, in two localities, viz. near Zandvliet Farm, Worcester Division, and near Touws River. It is identified provisionally, in the absence of material with ripe achenes, as *Myosurus minimus*.

In both localities it was associated with *Marsilia macrocarpa* var. *Burchellii*. The habitats are described. Other new localities for *Marsilia* are put on record, ecological, geographical, and taxonomic problems are indicated, and it is suggested that a general comparative study of the flora of vleis and similar habitats over the whole of South Africa is desirable.

Note.

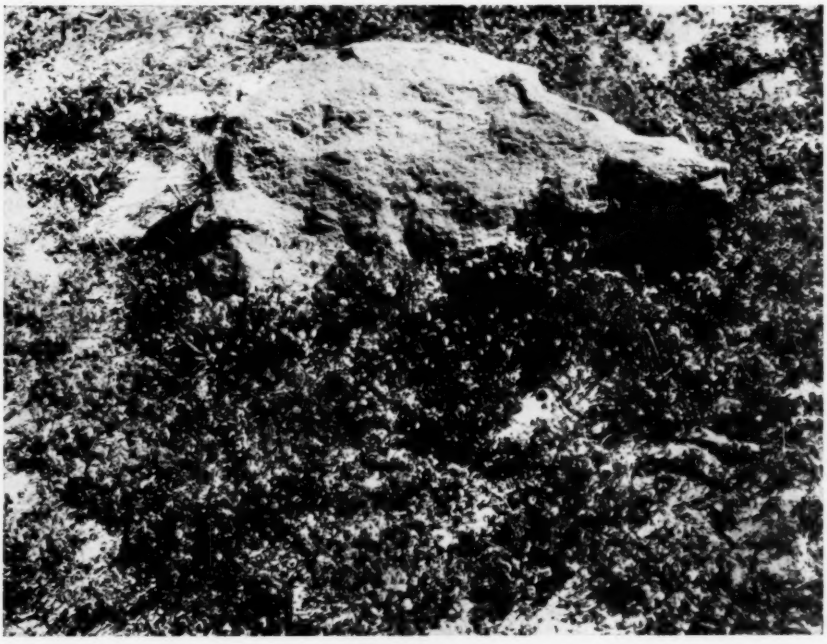
Since the above was communicated to the Society, Miss E. L. Stephens has very kindly informed me that she has found *Marsilia* (2nd October 1925) about eighteen miles north of Cape Town, near Philadelphia. "It had evidently been established there for a long time, as it covered a large area of marshy ground."

In a later letter she informs me that she found *Marsilia* in 1923 common in pans and vleis on the Karroo between Touws River and Ceres for 12 miles east from Touws River, but not extending to the Warm Bokkeveld; and draws attention to a record of a *Marsilia* (*M. capensis* A. Br.) from near Worcester, in Marloth's Flora of South Africa, vol. i, p. 76 (fig. 57).

D. T.

9th December 1927.

PHOTOGRAPH 1.



PHOTOGRAPH 2.

Neill & Co., Ltd.

THE BEHAVIOUR OF *ACACIA MELANOXYLON* R. Br. ("TASMANIAN BLACKWOOD") IN THE KNYSNA FORESTS: AN ECOLOGICAL STUDY.

By John F. V. Phillips, D.Sc. (Edin.).
Forest Research Station, Deepwalls, Knysna, C.P.

Introductory Remarks.

Some interesting and important features of ecological, sylvicultural, and economic nature are brought to light in the study of the behaviour of the exotic *Acacia melanoxylon* R. Br. in the indigenous forests at Knysna. The object of the present communication is to describe briefly observations and experiments connected with this behaviour, and to outline the conclusions drawn as a result of these observations and experiments.

History of Introduction.

The species was introduced to the Knysna forest region about 1856. Captain Harison, the first Conservator of the Midland Conservancy, in 1874, wrote that large trees of the species were to be found in the gardens of Knysna village; from other references it appears that the tree had been planted extensively in and around the town of George.

As the Colonial Secretary in 1876 pressed for the planting of burnt patches and other gaps in the forests, and urged the extension of the forest areas by means of exotics, Harison commenced raising the "Blackwood" in his nursery at Concordia. Ere the plants were large enough to be transplanted to the forest or macchia, Trimen published a note on the "Australian Bug," showing it to be a severe pest of "Blackwood." Harison immediately realised the danger of planting so susceptible a species, and stopped operations. His fears were well founded, for in March 1877 the insect actually did attack "Blackwood" at George and Knysna. So great was the alarm caused by the attack that no further attention was paid to the planting of "Blackwood" until 1889, when D. E. Hutchins—who followed Harison—planted it on a small scale as a living fire-belt; this work was continued by his successor, Cooper, in 1890 and 1891. Comparatively few trees were planted in these operations; indeed, it may be said that until

1909 no really serious attempt to introduce the species to the forest proper had been made.

In 1909 J. S. Henkel, then Conservator of Forests, Knysna, referring to the natural regeneration of the indigenous forests and the interplanting of these forests with exotics, wrote (Annual Report, Chief Conservator of Forests, for 1909, p. 17) that . . . there were profound relationships existing between species which it was essential to maintain in order to produce the best results. It was, however, possible that, by the introduction of exotics, the natural process of regeneration might be accelerated, and a quicker return obtained by a judicious introduction of a faster-growing species. He had given much thought to this subject and had discovered interesting examples of success. A remarkable instance at Wit Els Bosch Reserve could be quoted: it appeared that a single " Blackwood " had been introduced into the forest, the original tree, though somewhat injured by fire, was still standing, and from this tree an excellent group of well-grown " Blackwoods " had been produced; in some instances the dense canopy of the indigenous forest had been pierced by the vigorous exotics. Without man's assistance, and notwithstanding a dense growth of weeds, this establishment had been possible.

The outcome of Henkel's observations was that from about 1910 until 1922 " Blackwood " was planted in gaps in exploited forest, while until 1915 fire-belts composed of this species were formed along the margins of a number of forests. A very large proportion of the transplants and the root-suckers put out were either killed or damaged by elephant, bushbuck (*Tragelaphus sylvaticus*), grijsbok (*Pediotragus tragulus*), bluebuck (*Cephalophus monticola*), wild pig (*Potamochoerus choeropotamus*), and cattle. Undisturbed plants experiencing favourable light and soil conditions have grown vigorously.

The Behaviour of *Acacia melanoxylon* R. Br.

I.—*General Observations.*

Apparently the objects of the introduction of " Blackwood " into the exploited portions of the indigenous forests have been (*a*) to subjugate the rampant weeds following excessive removal of the upper canopy on one and the same site; (*b*) to accelerate the process of natural regeneration of indigenous tree species.

During the examination of various portions of the Deepwalls Forests in 1922–23, and of the Gouna and Sourflats Forests in 1923, it was noted repeatedly that " Blackwood " had in most instances fulfilled the first duty expected of it—the killing of troublesome weeds (e.g. *Helichrysum petiolatum*,

H. parviflorum, *Plectranthus fruticosus*, and *Rubus* spp.). So far from assisting in the processes of establishment, growth, and development of the natural regeneration of the native trees, it appeared actually to retard these processes.

Regeneration of native species was not only very, very rare under stands of " Blackwood," but also appeared moribund.

Two reasons for the poverty of regeneration were thought likely to exist: (*a*) the " Blackwood," when planted at a close espacement (4×4, 6×6, 8×8 feet apart) on small clearings in the forests, was suspected of *reducing the light-intensity so considerably that native seedlings were unable to establish themselves, or, if they were able to establish themselves, were unable to develop normally*; (*b*) the " Blackwood " was suspected of *drawing so strongly upon the supply of soil moisture that regeneration of the relatively delicate native species was unable to establish itself, or, if it did establish itself, was unable to develop normally.*

With the above as *hypotheses* the writer set out to test by definite experiment their veracity and relative importance.

II.—*The Reaction of* Acacia melanoxylon *on the Light-intensity.*

The light-intensity at ground-level in many " Blackwood " stands, ranging from 4 to 14 years of age, was determined by means of the Clements (1905) Stop-watch Photometer. Values as low as 1/50, 1/100, 1/150, 1/200, 1/300, 1/400, 1/500, 1/700 of full sunlight were registered. In no single instance did weed-growth of any kind exist under the trees, nor did regeneration of native trees occur, apart from scattered poorly developed plants of *Royena lucida*, *Burchellia*, *Plectronia Mundtii*, *Olea capensis*, and *Celastrus* spp. In several stands showing light-intensities of 1/30 and 1/40, and in one of intensity 1/100, some poorly developed seedlings, several inches high, of *Podocarpus* spp., *Olea laurifolia*, *Apodytes*, and *Curtisia* occurred, together with a few seedlings of the species previously listed.

From a series of light-intensity experiments carried out at Deepwalls it was known that seedlings of *Podocarpus* spp., *O. laurifolia*, *Apodytes*, and *Curtisia* could withstand for periods of six to twelve months such low intensities as 1/1000–1/2000, that they existed but scarcely grew under values 1/500–1/800, that they grew moderately but were delicate under values 1/200–1/400, and that they were vigorous under values 1/5–1/40. Accordingly, cultures of plants of these species, of known age (usually six to twelve months from germination) and of known history (raised in the nursery under known light-intensity and known moisture-content of the soil), were placed under several " Blackwood " stands, the average holard (total moisture-content of the soil) of the containers being regulated, and in

every instance being kept at a value as near as possible to the known optimum for each species. The soil used was normal, porous forest clay-loam (15–20 per cent. clay) of the type occurring on the sites where the "Blackwood" stands had been planted. The soil surfaces were sealed so that the holard might be regulated with care. The responses of the cultures may be summarised as follows :—

Podocarpus Thunbergii.—Average regulated holard (on dry-weight of ovened sample), 40 per cent.; *original* nature of the seedlings *vigorous* :

Under light-intensity 1/25, increment at end of six months 2½–3 inches, condition vigorous; under 1/100, 1–1½ inches, very fair; under 1/200, ½–1 inch, fair, tender; under 1/400, ½ inch, poor; under 1/600, no increment, poor.

Podocarpus elongata.—Average regulated holard, 35 per cent.; *original* nature of the seedlings *vigorous* :

Under light-intensity 1/25, increment at end of six months 3–3½ inches, condition vigorous; under 1/100, 2 inches, very fair; under 1/200, 1 inch, fair; under 1/400, ½ inch, poor; under 1/600, no increment, poor.

Olea laurifolia.—Average regulated holard, 40 per cent.; *original* nature of the seedlings *vigorous* :

Under light-intensity 1/25, increment at end of six months 2 inches, conditions vigorous; under 1/100, 1 inch, very fair; under 1/200, 1 inch, fair; under 1/400, ½ inch, fair; under 1/600, no increment, poor.

Apodytes dimidiata.—Average regulated holard, 45 per cent.; *original* nature of seedlings *vigorous* :

Under light-intensity 1/25, increment at end of six months 3 inches, conditions vigorous; under 1/100, 3 inches, very fair; under 1/200, 1½ inches, fair; under 1/400, 1 inch, poor; under 1/600, ½ inch, poor.

Curtisia faginea.—Average regulated holard, 40 per cent.; *original* nature of seedlings *vigorous* :

Under light-intensity 1/25, increment at end of six months 3½ inches, condition vigorous; under 1/100, 3 inches, very fair; under 1/200, 1 inch, fair; under 1/400, no increment, poor; under 1/600, no increment, poor.

These responses are of much interest and importance: they demonstrate that in the instances of stands showing a light-intensity lower than 1/200 at ground-level, development of the culture plants was not as good as that shown by plants of the same age, growing in the same type of soil, and receiving the same amount of water, but living under stands of "Blackwood" experiencing stronger light at ground-level; furthermore, they

indicate that, while development of the culture plants under light-intensities lower than 1/200 was not vigorous, the plants nevertheless, on account of receiving sufficiency of soil moisture, could live and could slowly grow. The information yielded by the cultures, combined with the knowledge that indigenous regeneration was sparse and poorly developed under " Blackwood " stands experiencing such congenial intensities as 1/10, 1/25, 1/40 at ground-level, seemed to suggest that the light-intensity reaction was not the prime one, although evidently an important additional one.

III.—*The Reaction of* Acacia melanoxylon *on the Holard.*

1. *Determination of the Holard in* Acacia melanoxylon *Stands.*—With the object of determining the average holard at definite depths under stands of the " Blackwood," a series of soil-cores was taken by means of a soil-borer, bi- or tri-weekly for the space of twelve months, at depths of 6, 12, 18, and 24 inches at certain stations, and at depths of 6 and 12 inches only at others. The cores were placed at once in air-tight containers, weighed, oven-dried until constant weight (usually after twelve to fourteen hours at 105° F.), further desiccated over calcium chloride for twelve hours, then rapidly reweighed.

A summary of holard values, together with notes concerning the stands, the light-intensity at ground-level, and the occurrence of regeneration of native species, is given in Table I, p. 36. The data in this table definitely show that the soil under " Blackwood " stands is much drier than that obtained from sites within the same locality but free of " Blackwood " ; the holard, indeed, is reduced to values closely approaching the echard (non-available moisture-content of the soil) for the particular soils and the particular species. The greatest reduction appears to be at depths of 18 and 24 inches—excavated quadrats or bisects show that the greatest development of the rootlets of " Blackwood " occurs between 15 and 24 inches, hence the drier nature of the soil between these limits. The control holard values given in Table I show the soil at 18 and 24 inches to be drier than that at 6 and 12 inches—here again the reason is that the greatest development of feeding rootlets of the native trees occurs at the 18–24-inches level.

Quadrats of 1 square metre, set out under the Stands 1, 2, and 5 described in Table I, revealed the information (*a*) that the increment of the naturally established native seedlings was either nil or exceedingly small ; (*b*) that many first-stage seedlings of *Podocarpus Thunbergii, Olea laurifolia, Apodytes, Curtisia,* and *Royena lucida* died before they could establish themselves—unless the weather happened to be particularly wet at the time of germination ; (*c*) that a number of the seedlings of several inches in height wilted

and died during dry spells—that is, if rain did not fall for the space of seven to twenty-one days, or if Foehnlike (" Bergwinds ") winds were prevalent.

TABLE I.—*Average Holard Values at Various Depths under* A. melanoxylon *Stands, together with Holard Values for control Sites.*

Stand.*	Light-intensity and aspect.	Natural regeneration of native tree species.	Depth of core.	Nature of the soil.	Average holard.	Nature of the control site.	Average holard.
			Ins.		%		%
1	1/40 Flat	A few *P. Thunbergii*, *Apodytes*, *Curtisia*, *O. laurifolia*, and *Royena* seedlings present; all poor.	6	Humus	19	Light 1/50; fairly open high forest, with *P. Thunbergii*, *O. laurifolia*, *Apodytes*, and *Curtisia* frequent.	40
			12	Sandy loam	17		35
			18	Clay loam	17		32
			24	,, (15 per cent. clay)	17		30
2	1/50 Flat	A few *P. Thunbergii*, *Curtisia*, *O. laurifolia*, *Burchellia*, *Plectronia Mundtii* seedlings; all poor; some dying at each dry spell.	6	Humus	16	Light 1/100; denser forest than above, with same spp.	43
			12	Sandy loam	16		36
			18	Clay loam	14		30
			24	,, (15 per cent. clay)	13		28
3	1/40 North	No regeneration; a few *Blechnum punctulatum*.	6	Humus	14	Light 1/200; close high forest rich in *P. Thunbergii* and *O. laurifolia*, with layers of *Trichocladus crinitus*.	35
			12	Sandy loam	12		33
			18	,,	11		26
			24	,, (8 per cent. clay)	10		26
4	1/25 North	No regeneration; a few *Aspidium capense*.	6	Humus	12	Light 1/75; open high forest, with *P. elongata*, *Ocotea*, and some *P. Thunbergii*.	30
			12	Sandy loam	10		27
			18	,,	..		
			24	,, (10 per cent. clay)	..		
5	1/100 South	A few *P. Thunbergii*, *P. elongata*, *Apodytes*, and *O. laurifolia* seedlings; all poor.	6	Humus	17	Light 1/150; high forest rich in *P. Thunbergii*, *O. laurifolia*, with some *Trichocladus*.	41
			12	Clay loam	15		35
			18	,,	..		
			24	,, (18 per cent. clay)	..		

* Stands planted 1912–14, all vigorous, usually 30–40 feet full height, girths from 18–24 inches at breast-height except in suppressed individuals; usually planted 3×3 or 4×4 feet apart.

2. *Holard Experiments.*—(i) On quadrats, each 4 metres square, set out under Stands 1, 2, and 5 described in Table I, carefully selected, viable seeds of *Curtisia*, *O. laurifolia*, and *P. Thunbergii* were sown: 300 of each species

to a quadrat, 3 quadrats in each stand. The seeds were protected from birds and mammals by means of fine wire-mesh. The degree of germination was recorded for each species on each of the 9 quadrats. A summary of the *germination* and *establishment* percentages follows :—

Stand 1, average holard at 6 inches 19 per cent., average light intensity 1/40. *Curtisia* : germination per cent. 57, establishment per cent. 5 (calculated on the number of plants that actually was yielded by the seed, and on the proportion of these plants that survived at the end of four months). *O. laurifolia* : germination per cent. 81, establishment per cent. 7. *P. Thunbergii* : germination per cent. 65, establishment per cent. 2.

Stand 2, average holard at 6 inches 16 per cent., average light-intensity 1/50. *Curtisia* : germination per cent. 62, establishment per cent. 4. *O. laurifolia* : germination per cent. 78, establishment per cent. 5. *P. Thunbergii* : germination per cent. 51, establishment per cent. 3.

Stand 3, average holard at 6 inches 18 per cent., average light-intensity 1/100. *Curtisia* : germination per cent. 69, establishment per cent. 4. *O. laurifolia* : germination per cent. 85, establishment per cent. 10. *P. Thunbergii* : germination per cent. 70, establishment per cent. 2.

It is seen that, while the percentage of *germination* was high, the percentage of *establishment* was extremely low, despite the very fair conditions of light experienced by the quadrats. The overwhelming majority of the deaths on the quadrats was due to wilting of the plants on account of insufficiency of moisture.

To serve as a control on the above experiment, nine quadrats were set out under normal forest condition, snot far removed from Stands 1, 2, and 5, these being sown with the same stock of seed as the quadrats under the *Acacia melanoxylon*. The results shown may be summarised here for comparison with those shown above.

Forest Sites 1, 2, and 3 : average holards at 6 inches, 40 per cent., 40 per cent., and 42 per cent. respectively ; average light-intensities, 1/50, 1/100, and 1/30 respectively. *Germination percentages* according to the three sites : *Curtisia* 59, 60, 63 ; *O. laurifolia* 75, 82, 75 ; *P. Thunbergii* 68, 64, 66. The *establishment percentages* corresponding to these figures were : *Curtisia* 83, 90, 91 ; *O. laurifolia* 90, 93, 88 ; *P. Thunbergii* 90, 90, 88.

(ii) Blocks of soil, 9 inches deep, 18 inches square, taken from " Blackwood " stands and containing a few naturally established seedlings each of *P. Thunbergii*, *P. elongata*, *O. laurifolia*, *Apodytes*, *Curtisia*, and *Royena lucida* were placed in tins, the soil surfaces being sealed with parawax-petrolatum ; the sealed cultures were kept under a light-intensity of 1/50 and received no water, the object being to cause wilting of the seedlings through very slow water loss.

The history of the experiment is summarised in Table II.

TABLE II.—*Wilting of Naturally Established Seedlings in Sealed Soil Blocks removed from* Acacia melanoxylon *Stands.*

Block.	Original holard of the block at 3 inches.	Species of seedlings.	Wilted at	Time required.	Soil nature.
	Per cent.		Per cent.		
1	18	*P. elongata* .	10	8 to 12 days.	Clay-loam : 15 per cent. clay ; 10 per cent. humus.
		P. Thunbergii .	11		
		O. laurifolia .	12		
		Apodytes . .	14		
		Curtisia . .	12		
		R. lucida . .	12		
2	16	*P. elongata* .	10	5 to 7 days.	Sandy-loam : 7 per cent. clay ; 8 per cent. humus.
		P. Thunbergii .	12		
		O. laurifolia .	12		
		Apodytes . .	13		
		Curtisia . .	12		
		R. lucida . .	12		
3	22	*P. elongata* .	11	14 to 21 days.	Clay-loam : 18 per cent. clay ; 10 per cent. humus.
		P. Thunbergii .	11		
		O. laurifolia .	12		
		Apodytes . .	13		
		Curtisia . .	13		
		R. lucida . .	13		

The experiment indicates that were no rain to fall for a period of fourteen to twenty-one days the seedlings of Block 3 would succumb ; that were it withheld for eight to twelve days from Block 1 death would follow ; and that the plants of Block 2 could not survive unless rain fell within five to seven days. The fact that the holard of the blocks so nearly approached the echard for the soil and the seedlings used is well demonstrated, especially in the instance of the second block, where the holard was but 3–6 per cent. above the echard.

(iii) Two 4-square-metre quadrats per stand were set out under " Blackwood " Stands 2 and 5 (*vide* Table I for details) ; these quadrats each showed a few seedlings of the following species : *P. elongata*, *P. Thunbergii*, *O. laurifolia*, *Apodytes*, *Curtisia*, and *R. lucida*.

These quadrats were watered so that their average holards wereincreased appreciably—thus quadrats 1 and 2, *Stand* 2, had their average holard at

6 inches raised from 16 per cent. and 15 per cent. to 30 per cent. and 32 per cent. respectively, while quadrats 1 and 2, *Stand* 5, were raised from holard 17 per cent. and 18 per cent. to 30 per cent. and 33 per cent. respectively. Four control quadrats containing seedlings of the same species *were left unwatered*, the object being to compare the nature of the seedlings on *holard-increased* quadrats with that of seedlings of the same species *on quadrats of low holard*. The responses of the seedlings at the end of six months may be summarised thus:—*P. elongata*: Watered quadrats—no deaths, all plants very fair. Control quadrats—mostly dead, remainder very poor. *P. Thunbergii*: Watered quadrats—no deaths, all plants very fair. Controls—mostly dead, remainder very poor. *O. laurifolia*: Watered quadrats—no deaths, all plants very fair. Controls—all dead except a few plants on 1 quadrat, and these very poor. *Apodytes*: Watered quadrats—a few deaths on 1 quadrat only, remainder very fair. Controls—all dead except a few plants on 1 quadrat, and these dying. *Curtisia*: Watered quadrats—a few deaths only, remainder very fair. Controls—all plants dead. *Royena*: Watered quadrats—no deaths, all plants very fair. Controls—a few dead, the remainder very poor. The influence of watering was evident from within a few weeks of its commencement: general improvement of the condition of the plants and a marked falling off in mortality. Unwatered plants, however, fared badly, especially as several drought and Foehn or "Berg" wind periods occurred during the course of the experiment.

From the determination of holard at several depths in various stands of "Blackwood" germination-establishment experiments, the unwatered soil-block experiments, and the increased holard experiment, it is manifest that "*Blackwood*" *reduces the soil moisture to a degree unfavourable to the normal development of the seedlings of* P. Thunbergii, P. elongata, Apodytes, O. laurifolia, *and* Curtisia, *and that it occasionally brings about the death of seedlings of these species by reducing the holard to points either equivalent to or below the echard.* It is known that seedlings of *Ocotea bullata, Platylophus trifoliatus, Cunonia capensis,* and *Ekebergia capensis* are just as sensitive to a greatly reduced water content as the species listed in the foregoing holard experiments, and there can be little doubt that "Blackwood" would have the same detrimental influence upon them.

Referring then to the two hypotheses concerning the poverty of regeneration of native species under "Blackwood" stands, it is seen that actually *both were true,* but that *the major reaction of the exotic is soil-moisture reduction, and the minor, light reduction.* Combined, the two reactions are exceedingly potent.

The Possibility of Undesirable Spread.

Assuming then that " Blackwood " is definitely detrimental to regeneration of the native species in the Knysna forests, the question whether there be danger of its spreading to an undesirable extent immediately arises. The following points throw much light upon this matter :—

1. " Blackwood " produces seeds in the greatest profusion : some trees are seldom found without seed, some seed several times per year, others bear rich crops annually. It is estimated, on the basis of counts of seeds produced by certain branches of certain trees, that the average tree of ten to fourteen years of age produces about 250,000 seeds each year.

2. The seeds are 90–99 per cent. fertile.

3. The seeds are dispersed by elephant, bushbuck, grijsbok, bluebuck, wild pig, field mice, voles, and cattle. Elephant, the bucks, wild pig, and cattle browse on the foliage of the tree, accidentally swallow the seeding shoots, and pass the seeds through their systems ; when deposited with the faeces the seeds are much softened and germinate within seven to twenty-one days. Occasionally bushdove (*Columba arquatrix*), the red-winged starling (*Amydrus morio*), and domestic fowl carry the seed over short distances, but the passing of the seed through the systems of these birds does not assist germination appreciably. On rare occasions ants may be seen bearing freshly fallen seeds over short distances for the sake of the oily matter at the hilum.

The seeds are carried long distances by water—heavy rains, streams, and rivers. The planting of a small patch of " Blackwood " near the banks of the " Rondebos " River, Deepwalls, in 1915, has been responsible for the dispersal of seed and the consequent establishment of seedlings, poles, and trees of this species along the whole length of this watercourse and allied streams—a distance of not less than 20 miles of stream-bank. In the same manner " Blackwood " planted at Jubilee Creek, Millwood, about 1913, has supplied seed for dispersal by the " Forest Creek " stream and the " Homtini " river—dense patches of regeneration of all sizes now being found along the banks of these courses.

4. The small, hard seeds are decidedly long-lived. Cambage (1924) has shown that these may germinate freely after seven and a half years' immersion in sea-water. The following experiment at Deepwalls indicates that the seeds are capable of lying dormant until such time as they are stimulated to germinate through rupture of the testae by trampling, or softening of the testae through agency of fire :—

An area situate 10–15 yards north of a stand of " Blackwood " planted in 1912, until 1924 bore a dense 15–20 feet high thicket of *Halleria lucida*, *Rhamnus prinoides*, *Polygala myrtifolia*, with a luxuriant undergrowth of

Blechnum capense. From a 100 square yards of the area all the vegetation was very carefully removed in 1924 : thousands of seeds of " Blackwood " were lying either on or immediately below the soil surface, but not a single seedling occurred. The 100 square yards were then trampled by several labourers for the space of five minutes, the seeds being trampled with the soil. Within several weeks a dense regeneration of *Acacia melanoxylon* appeared on the site.

From a second 100 square yards the vegetation was very carefully removed, but no trampling was done. Seeds of " Blackwood " lay upon the soil in thousands : apart from small portions unavoidably disturbed in the clearing process, the area showed no regeneration at the end of several months.

From a third 100 square yards the vegetation was removed, and portions of the soil were fired by means of igniting spread-out brushwood : the fired soil at the end of several weeks bore a most luxuriant and dense crop of " Blackwood " seedlings.

5. Regeneration of " Blackwood " is *decidedly light-demanding* and does not develop normally unless the light-intensity is above 1/6 of full sunlight. A large number of naturally established seedlings, growing under intensities of 1/12, 1/15, 1/20, have been kept under observation since April 1924, and it has been found that these plants, although three to four years of age, still retain their *juvenile* foliage, and are attenuated, whippy, etiolated, and tend to fall under the weight of their own foliar shoots.

6. Regeneration receiving sufficient light and growing in forest soil develops rapidly : plants 20 feet in height, 6–9 inches in girth, are produced in two to three years.

7. The tree sends up an abundance of *root-suckers* whenever the roots are in any way disturbed ; such *suckers* may occur 30–60 feet away from the parent bole, and are capable of growing into normally shaped, large trees, which in turn produce seed and *suckers.*

8. The root-system of " Blackwood " is extensively developed, radiating 70 to 100 feet from the boles in instances of large trees.

In view of the facts that " Blackwood " produces an abundance of seed of high viability and suckers freely, that the seed is dispersed to some extent by birds and mammals, and to a greater extent by water, that the seed is capable of lying dormant for lengthy periods, and that the regeneration is very fast-growing under congenial conditions, it seems that there is strong possibility of the plant spreading considerably in time. On the other hand, the facts that the seed requires stimulating before it will germinate, and that the regeneration cannot develop normally under any but strong light, argue that in normal undisturbed forest where the degree of stimulation the seed would receive would be negligible, and where the

light-intensities are usually of a low order, the degree of establishment would be very slight indeed. On exploitation of such forest, with consequent trampling of the soil by man and beast, and opening up of the canopy, germination and establishment would occur wherever seeds of "Blackwood" were lying. Disturbance of the ground in the vicinity of existing trees would account for the appearance not only of regeneration, but also of large numbers of *suckers*.

The likelihood of the plant spreading in the macchia or "fijnbos" seems to be very slight, for even when the latter community is burned, slashed, grazed, or otherwise disturbed, the "Blackwood" does not thrive on the compact, acid soil, remaining stunted and unassertive.

On the whole, provided disturbance of forest in the soil of which seed of "Blackwood" lies dormant is not carried out to excess and on a large scale, there seems little danger of the plant becoming uncontrollable; in the opinion of the writer, Willis (1922) is correct in stating that native floras are not seriously influenced by exotic species unless agents of disturbance—principally the activities of man—assist the advances of the latter.

Conclusions.

"Blackwood" acts detrimentally upon the regeneration of the more important forest species, and is a plant that might become commoner if forest containing its dormant seeds were to be disturbed.

Despite its value as a timber producer and its efficiency as a destroyer of rampant weeds on open sites within the forests, it is considered that it would be unwise to continue to plant up gaps in the main forest with this species. On the other hand there seems no reason why burnt or otherwise ruined patches, and isolated patches of poor quality, should not be interplanted with the exotic, as such patches if left to nature would require many centuries to right themselves sufficiently to produce timber of much value.

Summary.

1. *Acacia melanoxylon* R. Br., the "Tasmanian Blackwood," was introduced to the indigenous forests at Knysna on a sylvicultural scale in 1909, with the objects of killing weed-growth on exploited sites and assisting natural regeneration of indigenous trees.

2. Observations in 1922–23 showed that, while the weeds were killed by the exotic, natural regeneration of tree species was either absent or poor under its stands.

3. Experiments showed that two reactions were responsible for this

dearth and poverty of regeneration: reduced light-intensity and reduced moisture-content of the soil, the latter being far the more important.

4. The species, while seeding efficiently and abundantly, is not likely to spread in undisturbed natural forest on account of the seed requiring stimulation ere its germination is possible, and because its regeneration is markedly light-demanding. The seed lies dormant for many years, and may thus cause the spread of the species in years to come when forest now undisturbed is reworked.

5. Despite its value as a timber tree and its efficiency as a killer of weeds on open sites, it is not considered wise to plant the species in gaps in the main forests, but to confine its production to burnt and otherwise ruined patches and isolated forests of poor quality.

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SOME OBSERVATIONS ON THE PRODUCTION OF EXCITEMENT PALLOR IN REPTILES.

By Lancelot Hogben and Louis Mirvish.

(With two Text-figures.)

The phenomena of colour change in Reptiles have been studied up to the present less extensively than among the Amphibia and fishes. In general, the agencies whose effect has been noted with general agreement are temperature, illumination, and certain forms of nocuous stimulation. Warmth, as in Amphibia and fishes, promotes the withdrawal of the pigment from the cell processes of the melanophores, but the reaction, according to the observations of Redfield on the Mexican lizard *Phrynosoma*, depends on a local mechanism. The reaction to light both in the chameleon and in *Phrynosoma* is undoubtedly a local one, being quite independent of the organs of vision. Bright illumination at moderate temperatures induces expansion of the melanophores; darkness evokes pallor. There is, however, a third type of chromatic reaction which apparently demands a co-ordinating mechanism. This is the phenomenon of excitement pallor. In this case a locally applied nocuous stimulus of sufficient intensity calls forth a generalised contraction of the melanophores throughout the body.

The phenomenon of excitement pallor was very carefully studied by Redfield in *Phrynosoma* (1917). As the result of his investigations Redfield came to the conclusion that the main factor in distributing the stimulus to chromatic response after nocuous stimulation is the liberation of adrenaline into the circulation. It had long been known that adrenaline induces contraction of the melanophores of vertebrates; and the new evidence adduced by Redfield seemed to point very strongly to an endocrine control of excitement pallor. The chief points which he records are: (*a*) failure of animals to respond to electrical stimulation of the roof of the mouth after section of the cord at a point between the 8th and 13th vertebra, (*b*) failure of animals to respond in most cases after epinephrectomy, (*c*) failure of local section of nerves to selected areas to interfere with the response in any way.

Following as they did upon Cannon's researches into the rôle of the adrenals in sympathomimetic accompaniments of excitement in the mammal, these results were fully consonant with what appeared to be the correct explanation of excitement in warm-blooded vertebrates. The criticisms that have been brought to bear upon the work of Cannon and his collaborators by Stewart and his colleagues have reopened the question; and it is now very doubtful whether it is possible to define any specific conditions in which increased liberation of adrenaline from the suprarenal medulla of mammals takes place. Consequently the determination of excitement pallor in Reptiles acquires, as Stewart himself has observed, a new interest in relation to the attempt to interpret a physiological, as opposed to pharmacodynamic, rôle for adrenaline in the animal body.

Phrynosoma, though displaying the chromatic reaction more noticeably than other common lizards of the North American continent, is by no means the most felicitous type to select for the study of this phenomenon. As is proverbial, the chameleons among *Lacertilia* afford the most striking display of colour change. Yet curiously, though the property of colour response in the chameleon has been noted from antiquity, being mentioned in Aristotle's Natural History, there has to the best of our knowledge been no more recent investigation of the physiology of colour response in the chameleon than Keller's extension (1895) of earlier work by Brucke (1854). As there is an exceedingly common species in the Cape Peninsula (*C. pumulus*), it seemed desirable, in view of the importance of the theoretical issue adumbrated above, to reopen the question. The experiments here recorded refer exclusively to the determination of excitement pallor.

Chameleons do not ordinarily respond to rough handling by pallor, but the application of a faradic current from an ordinary shocking coil to the roof of the mouth, or merely mechanical stimulation of the cloaca, calls forth a generalised lightening of tint. Mechanical stimulation of the roof of the mouth failed to evoke the response. The time relations of excitement pallor are worth noting in contrast with the phenomena of colour change in Amphibia. They are illustrated in the following protocol:—

	h. m. s.	
Time	0.00.00.	Stimulation of roof of mouth.
,,	0.00.30.	Stimulation ceased. Noticeable pallor.
,,	0.00.50.	Pallor complete.
,,	0.02.00.	Noticeably darker.
,,	0.09.00.	Darkening complete. Stimulation of roof of mouth.
,,	0.09.30.	Stimulation ceased.
,,	0.09.50.	Pallor complete.
,,	0.11.00.	Noticeably darker.

	h. m. s.	
Time	0.19.30.	Stimulated roof of mouth. Darkening not quite complete.
,,	0.20.00.	Stimulation ceased.
,,	0.20.05.	Complete pallor.

In general we found that pallor was complete within from half to two minutes from the beginning of stimulation.

2. The Effects of Spinal Transection.

It had been our intention to investigate the effects of epinephrectomy in the chameleon. The adrenals are in a specially accessible position for operative procedure and the difficulties of preserving aseptic conditions do not arise. At the threshold of the investigation, however, experience of nocuous stimulation, after the nervous connections of the adrenals with the area affected had been cut, so clearly showed that the mechanism of excitement pallor in the chameleon is in the main nervous, that it seemed unprofitable to approach the problem from this angle.

When the cord is cut at any point between the head and the middle of the trunk region, stimulation of the roof of the mouth always produced a pallor confined to the segment in front of the point of section as indicated diagrammatically in Nos. 1–4 in text-fig. 1. Behind a point indicated by the arrow in No. 5, stimulation of the roof of the mouth produced a general pallor, which usually did not include the tail. From this it might be concluded that some preganglionic nerve connections of the skin of the legs and base of the tail leave the cord well in front of the pelvic region. Or it might be argued, on the other hand, that the segmental pallor induced by stimulation when the cord is cut in front of the region where the adrenals lie is purely nervous, but that when the adrenal nerve connections are left intact, pallor is induced in the region behind the cut by the outpouring of adrenaline. The nature of the phenomenon does not favour the second alternative, for the pallor of the region behind the cut in No. 5 is just as intense and appears synchronously with the pallor in front. We can, however, distinguish between these two interpretations by reversing the procedure and stimulating the cloaca. In this case the results are represented diagrammatically in Nos. 6–8. The pallor is now restricted to the region behind the point of section.

Similar results to those figured in Nos. 6–8 are obtained when the cut end of the cord is stimulated mechanically or electrically on its cephalad aspect, *i.e.* when a descending disturbance is propagated along the cord from the cut end to the posterior extremity. The phenomenon is perfectly

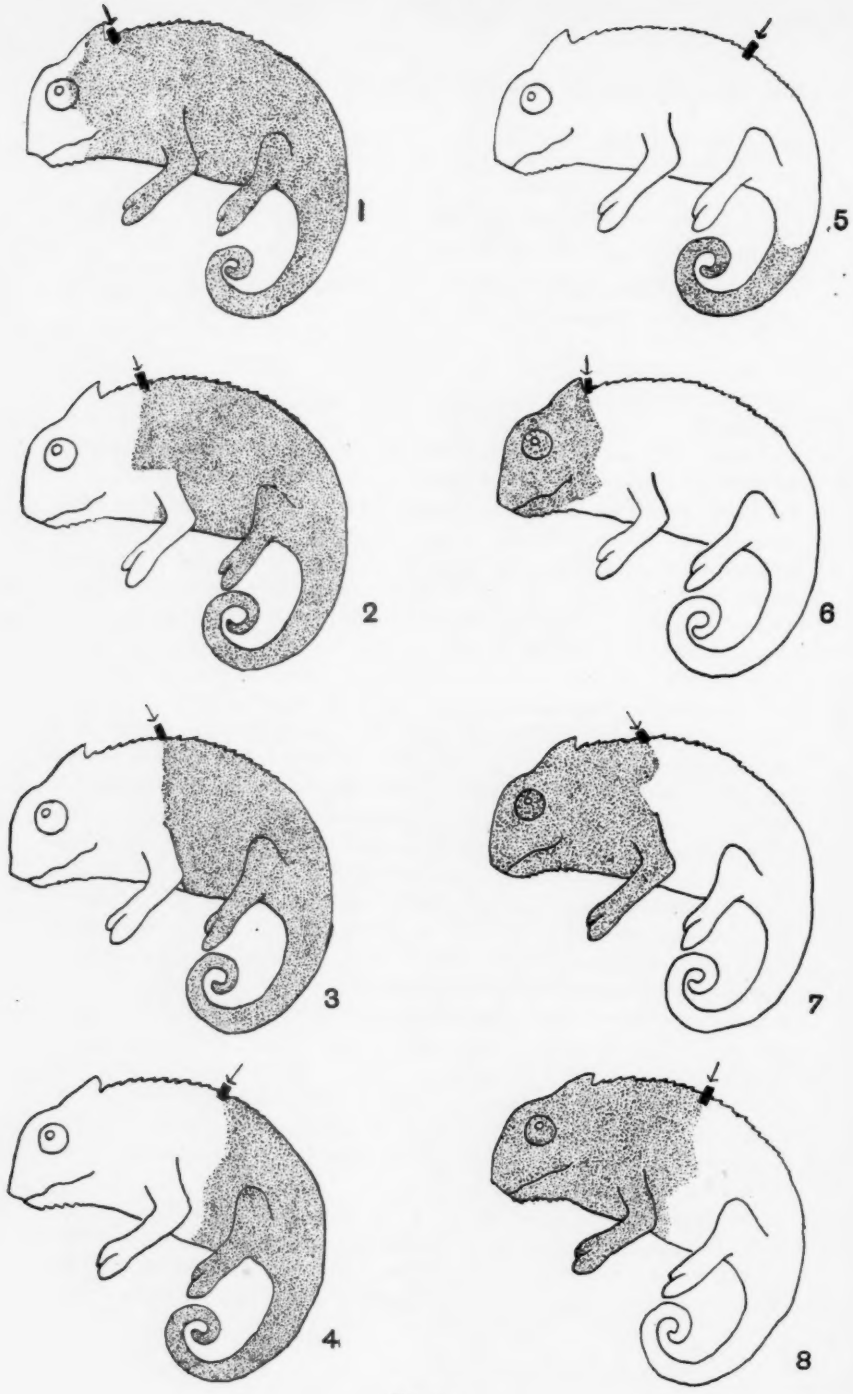

FIG. 1.

segmental. If adrenaline were liberated into the circulation, it would affect all parts of the body simultaneously. The fact that local pallor can be induced when the nocuous stimulus is applied to an area which is cut off from nervous connection with other parts that remain dark, even though its nervous connections with the adrenals remain intact, is sufficient to

FIG. 2.—Effects of transection of cord. *A*, stimulation of roof of mouth. *B*, stimulation of cloaca.

dismiss the possibility that endocrine factors enter significantly into the phenomenon. It may still be asked whether adrenal secretion does not reinforce the effects of continued stimulation. It was found that continuous application of a nocuous stimulus to the mouth or cloaca for ten minutes, when the cut is made in the region indicated in No. 4, produced only pallor behind the point of section.

How striking is the localisation of the response is well seen in the actual photographs here reproduced in text-fig. 2.

3. Action of Adrenaline.

Some further light is thrown on the possibility that adrenaline secretion enters significantly into the phenomenon of excitement pallor in the chameleon by a study of the minimal effective dose. In these experiments synthetic adrenaline (Suprarenin hydrochloride synth. of Messrs. Hoechst) was employed. In all experiments below the injection was intraperitoneal to ensure rapid absorption, and the dosage indicates the equivalent amount in 1 c.c. of saline solution.

Two medium-sized chameleons were injected with 1 : 10,000. General pallor resulted within five minutes. The pallor was more intense, and the hue more yellowish than in any case of pallor which supervened after nocuous stimulation. The condition persisted for about thirty-six hours.

A chameleon of the same size (as nearly as possible) became completely pale within ten minutes after an injection of 1 : 50,000. The condition persisted for the period of three hours during which it was under observation. The pallor in this case was accompanied by the same intensely yellow tint. Three other chameleons of about the same size received respectively 1 : 150,000, 1 : 300,000, and 1 : 500,000. An incomplete and somewhat patchy pallor, in no case extending over the whole body, ensued in all three cases, and subsided within an hour. Four chameleons which received a dosage of 1 : 1,000,000, 1 : 5,000,000, 1 : 10,000,000, and 1 : 50,000,000 displayed no response whatever.

From these observations it is seen that there is a fairly definite threshold effective dose, that the minimal quantity is from a physiological standpoint very considerable, and that this quantity produces a response which persists for a period which is very protracted in comparison with the effects observed in connection with the phenomenon of excitement pallor. It is clear that neither of these conclusions reinforce the likelihood that adrenal secretion plays any significant part in the production of excitement pallor.

The persistence of the response to adrenaline secretion is in keeping with the effects of adrenaline on other effector systems in cold-blooded animals. Thus the pressor effect, which in mammals is so characteristically evanescent, may be prolonged over a period of over quarter of an hour in the case of the tortoise (Hogben and Schlapp, 1924). Whatever explanation may be given to this persistence, it implies that if adrenal secretion entered into the phenomenon of excitement pallor, prolonged nocuous stimulation should evoke a more lasting pallor than stimulation for shorter periods. Whether such is actually the case may be inferred from the following protocol :—

Time 00.00. Stimulated one minute. Complete pallor at end.
„ 04.00. Dark again.
„ 05.00. Stimulated five minutes. Complete pallor.
„ 12.30. Dark again.
„ 13.00. Stimulated fifteen minutes. Darkening began about eight minutes after stimulation began and complete by time current was cut off.

Thus in the case of a stimulus applied for one minute, recovery took three minutes. With a stimulus of five minutes' duration, recovery took place in two and a half minutes, and with more prolonged stimulation, recovery supervened before the cessation of stimulation.

4. The Nature of Nervous Control.

The evidence brought forward in Section 2 clearly indicates that the pallor resulting from nocuous stimulation is predominantly if not wholly nervous. Two alternatives now present themselves: Is this control exercised through direct innervation of the pigmentary effectors, or is the production of pallor due to some chemical conditions such as oxygen-want, resulting from extreme constriction of the peripheral arterioles? As has been pointed out by one of the writers, the latter possibility has too frequently been overlooked. In this case it can be rejected on experimental grounds by cutting out the influence of the circulation. If the body is divided into strips by section at right angles to the longitudinal axis, pallor can always be induced in isolated segments of the trunk by electrical stimulation of the cephalad end of the C.N.S. The experience can moreover be repeated again and again on the same strip. It is very difficult to believe that a reversible effect of this kind could be repeated after the circulation had been stopped, unless the pigmentary effector organs were in direct connection with the central nervous system. And it thus seems legitimate to draw the conclusion that the production of excitement pallor depends on the direct innervation of the melanophores in Reptiles. It should be borne in mind that there is no available histological evidence for the direct innervation of the pigmentary effectors in Reptiles and Amphibia, though the nervous connections of the melanophores of fishes have been observed by more than one investigator.

5. Summary.

The conclusions which may be drawn from these experiments are as follows :—

1. The production of excitement pallor in chameleons is shown by spinal transection to be determined by a segmental mechanism.
2. The possibility of evoking pallor by stimulation of the cord in isolated segments after the circulation has been cut off, indicates that the pigmentary effector organs are under direct nervous control.
3. It is unlikely that adrenal secretion plays any significant part in the determination of excitement pallor in chameleons.

In view of the doubts that have been thrown on Cannon's interpretation of excitement phenomena in mammals, it would therefore seem desirable that the determination of excitement pallor in *Phrynosoma* should be reinvestigated.

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NOTE ON A WHALE BURIED ON THE CAPE FLATS.

By E. L. Gill, D.Sc.

The occurrence put on record in this note may possibly prove of interest when the recent geological history of the Cape Flats comes to be studied with the attention it deserves.

Early in July, 1927, I was told that some large bones had been met with in a quarry at Yzerplaats, on the Cape Flats near Maitland, about 3½ miles north-east of the City Hall, Cape Town. The quarry is owned and worked by the Harbour Authorities, who obtain material from it for use as a filling for breakwaters. It is a shallow but very extensive quarry in the superficial deposits. In a few places the Malmesbury Slates are exposed in the floor, but in order to maintain a run-off for water the digging over most of the area is not carried down to solid rock.

In working back the seaward side of the quarry the workmen had for some time been finding at one place the crumbling bones of some large animal, and eventually they had come to something which was rightly taken to be a skull. Work was stopped at the spot, and I was kindly taken out by Mr. Olive, of the Harbour Engineer's Department, to examine the remains. Further digging and washing soon revealed the shape of the back of a whale's skull. The substance of the bone was extremely rotten; it tended to fall to pieces even while it was wet, and portions that were subsequently dried crumbled to powder. But enough was seen to show that the skull was that of a rorqual (genus *Balaenoptera*). The size was about that of a full-grown Sei Whale, *Balaenoptera borealis*. The heads of a few ribs were washed out of the clay just behind the skull, and in the foreman's office I was shown one of the occipital condyles and parts of several vertebrae that had proved sound enough to dry out without much crumbling.

The layer on which the skull was lying was about 12 feet below the surface of the ground. The section exposed in the face of the quarry at this point, from the top downwards, was as follows: surface ironstone ("laterite") 4 feet; sand 2 to 3 feet; clay 6 feet. The clay is very tough and pure; foreign bodies of any kind are hardly ever found in it, though I hear that one other, a shark's tooth, has subsequently been taken out.

As nearly as could be ascertained, the whale's skull was lying about 10 feet above present sea-level, and the position is about a mile from the present shore of Table Bay. Everything pointed to the conclusion that the whale's carcase was whole when it came to rest at this spot. A dead whale may be thrown up by a heavy sea to about high-tide mark on a beach, but this clay was not a beach deposit, and was homogeneous from considerably above to considerably below the whale. The occurrence of the skeleton in this position seems to imply a fairly recent rise of level of the Cape Flats in relation to the sea—a rise probably amounting at the least to 12 feet.

We are indebted to Mr. Olive, and to Mr. Glynn, chargeman at the quarry, for bringing this occurrence to notice.

THE DINOSAUR BEDS OF LAKE NYASA.

By F. Dixey, D.Sc., F.G.S.

(Communicated by Dr. S. H. Haughton.)

(With four Text-figures.)

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I. Introduction.

While the Dinosaur Beds of Tendaguru in Tanganyika Territory have been known for many years, those occurring along the north-western shores of Lake Nyasa have been proved to exist only during the last two years. The fossils yielded by them have nevertheless been shown to be of considerable interest, and they include at least one form—a fossil tortoise—not previously described from amongst the more extensive Tendaguru collection. Beds of approximately the same age that yield corresponding reptilian remains are known to occur at only one other place in Africa, namely Uitenhage, in Cape Province, but similar remains have been recorded from the Island of Madagascar.

Towards the middle of 1924 Mr. E. C. Holt, of Nyasaland, was kind enough to send to me at Zomba a few fossil bones he had found at Mwakasyunguti in North Nyasa, and these were subsequently identified by Dr. S. H. Haughton as representing Sauropodous Dinosaurs. Within a few weeks of the receipt of the fossils I was able to visit the locality in company with Mr. Holt, and it was then obvious that a new formation existed there that had not previously been recognised; it would be necessary to separate

these beds from the Karroo on the one hand and from the so-called Recent on the other, which had been observed many years before in the course of the reconnaissance survey of that region, carried out by A. R. Andrew and T. E. G. Bailey.* Accordingly, I decided to return to the North Nyasa area in the following year with the object of re-examining these different sediments; the results of this survey as regards the Karroo † and the Tertiary,‡ as well as the relation of the younger sediments to the Nyasan Rift Valley,§ have already been made known,‖ and it remains in this paper to offer an account of the Dinosaur Beds themselves.

II. The Dinosaur Beds.

(a) *General Description.*

The Dinosaur Beds lie within the Nyasan Rift Valley at an average distance of about 8 miles from the north-western shores of Lake Nyasa (fig. 1). Apart from two minor interruptions they extend from Florence Bay north-westwards to the Songwe River, a distance of 78 miles, and thence continue north-westwards for some miles into Tanganyika Territory, where they disappear beneath sediments and volcanic rocks of Tertiary and post-Tertiary age. Moreover, they are for the most part confined within several long, narrow rifts, separated by ridges of crystalline rocks, that run parallel with the main rift valley and the shores of the lake; these minor rifts and the accompanying crystalline ridges sometimes attain to lengths more than 30 miles. As the beds are followed inland to Sungwa, 11 miles distant from the lake shore, they attain a maximum height of about 850 feet above lake level, or 2370 feet above the sea.

Throughout the greater part of their extent the Dinosaur Beds rest upon the crystalline rocks, but in the Nkana and Mpata areas, as well as in the northern part of the Mount Waller area, they have taken advantage of the broad depressions resulting from the early erosion of the non-resistant mudstones that form the local upper Karroo; accordingly, in these areas the Dinosaur Beds overstep across the post-Karroo faults on to the Karroo sediments and then back again on to the crystalline rocks. The Dinosaur

* "Geology of Nyasaland," Q.J.G.S., vol. lxvi (1910), p. 189.

† F. Dixey: "Notes on the Karroo Sequence North-west of Lake Nyasa," Trans. Geol. Soc. S. Africa, 1926, p. 59. Also S. H. Haughton, "On Karroo Vertebrates from Nyasaland," Trans. Geol. Soc. S. Africa, 1926, p. 69.

‡ F. Dixey: "The Tertiary and post-Tertiary Lacustrine Sediments of the Nyasan Rift Valley," Q.J.G.S., vol. lxxxviii (1927), p. 432.

§ F. Dixey: "The Nyasaland Section of the Great Rift Valley," Geog. Journ., 1926, p. 117.

‖ F. Dixey: "Recent Investigations into the Geology of Nyasaland," Inter. Geol. Congr. (Madrid), 1926.

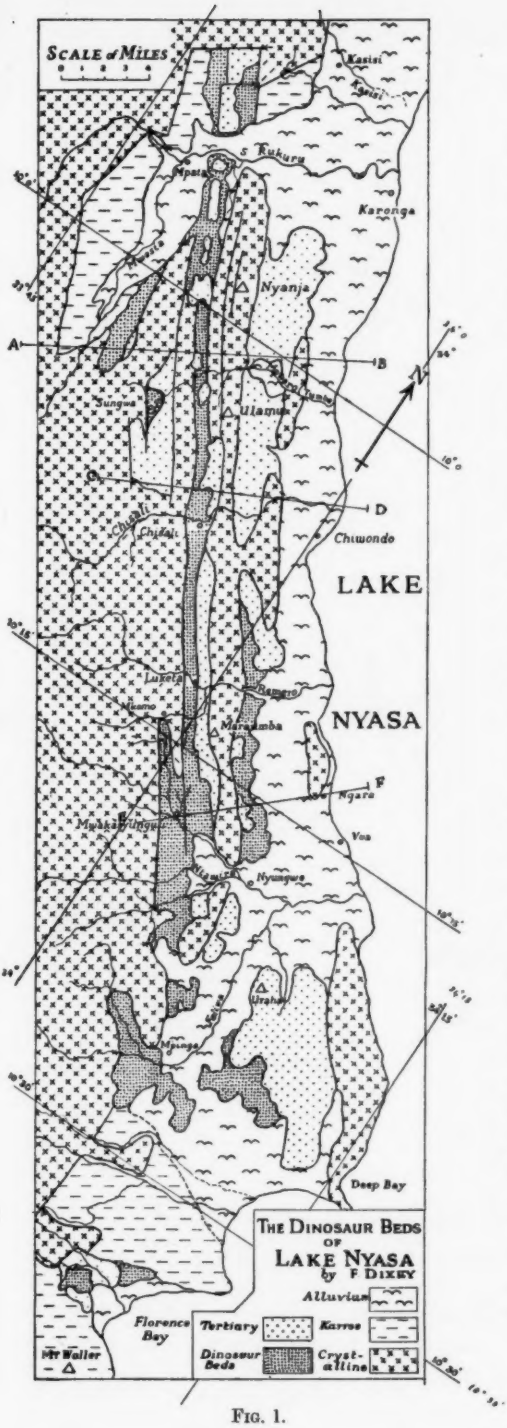


FIG. 1.

Beds are themselves overlain in turn by all the different members of the Tertiary and post-Tertiary Lacustrine Series, and these later rocks invariably show dips that are lower than those of the Dinosaur Beds.

The Dinosaur Beds comprise principally a great thickness of friable sandstones, sandy marls, and clays; in the lower part of the formation, occupying about half the total sequence, red, mauve, and purple tints most frequently occur, but in the upper part red marls tend to alternate with white sandstones. The frequent faulting that has taken place, combined with the absence of suitable maps, makes it difficult to form any very reliable estimate of the total thickness of the beds, but they would appear to be fully 1200 feet in thickness, and possibly considerably more.

It has already been mentioned that the Dinosaur Beds have been down-faulted against the older rocks along the line of several narrow rifts (figs. 1 and 2). The strike of the beds run more or less parallel with the rifts, and the beds generally dip towards the north-east in amounts varying from 10 to 30 degrees; accordingly, the crystalline rocks tend to rise to the surface along the south-western margins of the

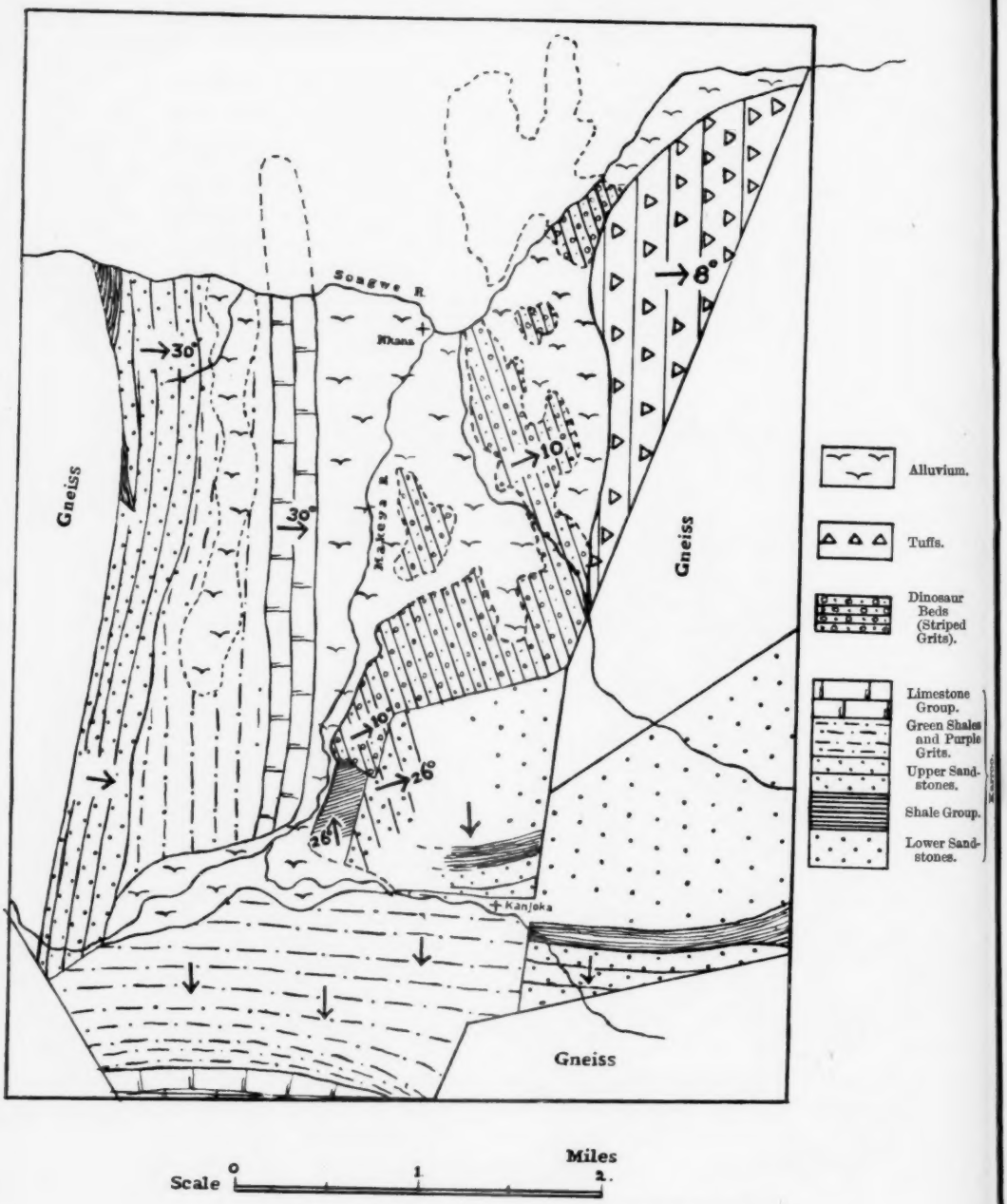


FIG. 2.—Geological sketch-map of the Nkana area, Nyasaland.

rift-valley floors (see figs. 1 and 3). The surface of unconformity is usually a very even one; below it the rocks are weathered to a soft and friable condition, and also they are deeply stained in red and purple tints similar to those of the overlying basal Dinosaur Beds. No folding has been observed in these sediments.

The outcrop of the Dinosaur Beds, together with that of the overlying Tertiary Lacustrine Series, gives rise to topographical conditions of considerable interest. The friable nature of most of these sediments, combined with the variations of lake level since pre-Pliocene times and the progressive recession of the north-western shore-line, has led to rapid sub-aerial erosion of the beds during a considerable period and to the production of bad-land topography. As a result partly of the strong relief and partly of the highly porous nature of the beds, the water-supply conditions in the area are very poor, so that vegetation can be maintained only during and shortly after the rains. Accordingly, for the greater part of the year, the outcrop of the sediments is represented by a jumble of bare, steep-sided, crumbling hills, rising to heights of several hundred feet, which are freely overlain by masses of pebbles and rock debris. Moreover, since these areas generally lie along minor rift valleys running parallel with the lake shore, the intermittent lake tributaries coming down from the mountain sides run straight across them and traverse the intervening crystalline ridges in a series of deep, narrow, steep-sided gorges.

(b) *Lithology.*

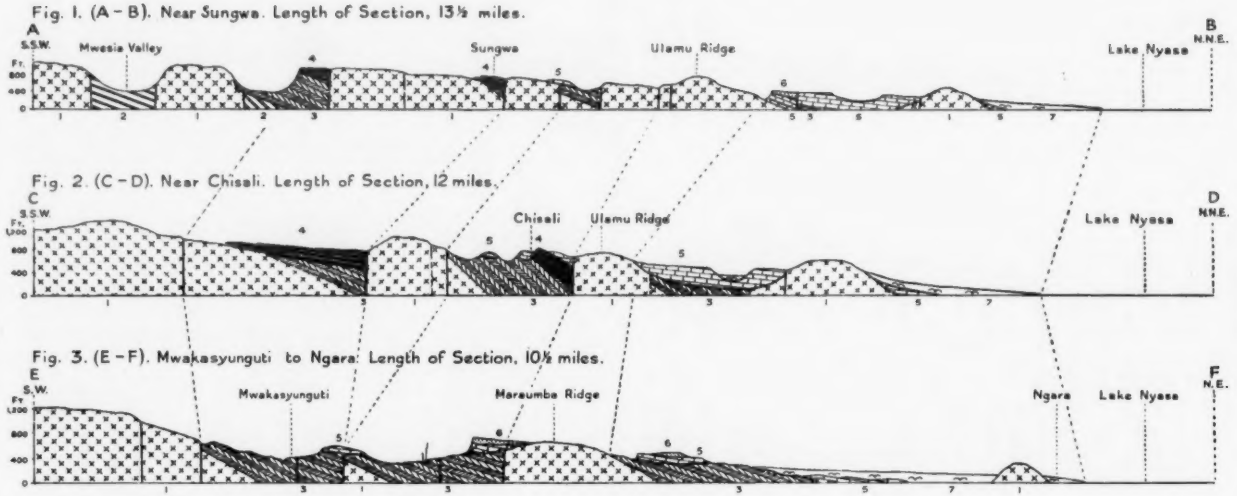
The following description of the Dinosaur Beds applies particularly to the southern or Mwakasyunguti area, where they are typically developed; as they are followed northwards a different facies gradually sets in, as will be seen in a later paragraph.

1. *Lower Beds.*—In general the basal beds overlap very gently on to the planed-off surface of the older rocks. Normally there is no development of a distinctive basal phase, apart from a layer of pebbles and rock debris only a few inches thick. For example, on the western side of Mwakasyunguti Valley, several miles south of the village, the Dinosaur Beds are seen to rest on an even surface of a banded gneiss, much decomposed and stained. The actual junction was sometimes obscured by a soft, greyish, rubbly deposit, gritty and friable, that probably represented the old surface soil, and upon this surface lay a thin bed of conglomerate. The conglomerate consisted of nodules of white and flesh-coloured cherty limestone, sometimes gritty, ranging up to 3 inches in length, as well as quartz-pebbles and gneissose fragments, and much decomposed pebbles and lumps of gneiss up to 8 inches in length. The beds above were of normal character,

SECTIONS

illustrating the structure of the country lying along

the North-Western Shores of Lake Nyasa.



1. Crystalline Rocks. 2. Karroo. 3. Dinosaur Beds. 4. Sungwa Beds. 5. Chiwondo Beds. 6. Chitimwe Beds. 7. Alluvium.

FIG. 3.

and they overlapped gently on to the crystalline rocks. In other localities also the basal bed is thin; the pebbles are usually small, about 1 inch in diameter, and they include quartz pebbles and nodules of cherty limestone; moreover, the deep weathering and staining of the underlying beds is a general feature.

The lower Dinosaur Beds can generally be distinguished in the field by a deep red tint that is partly due to weathering; moreover, they are more strongly coloured and less clearly striped than are the upper beds. The predominant tints in the fresh rock are red, purple, and mauve, and the beds as a whole consist of grits and sandstones, locally pebbly, with bands of marl and marly sandstone.

The lowest beds are mainly massive purplish grits, sometimes pebbly. Then sandstones and marls come in, with an occasional light-tinted or pale-green band. The bedding when present is usually regular, and it is maintained over considerable distances; current-bedding and contemporaneous erosion are but rarely seen. Rubbly marls and soft marly sandstones become more numerous towards the top, and red marls often alternate with relatively thin and hard bands of purplish grit and sandstone, which tend to weather out as ribs and tables; at the same time the colours become less intense.

In general, the lower beds are regularly bedded and often thoroughly hard and flaggy; moreover, they are thick-bedded as compared with the upper beds, besides being frequently harder and more uniform in colour.

The Dinosaur bones and bone fragments occur but rarely in the lower beds.

2. *Upper Beds.*—The upper Dinosaur Beds are characterised by strong current-bedding and contemporaneous erosion, as well as by a marked alternation of red and white colouring; the red bands are usually of a marly, clayey, or shaly nature, whereas the white are sandy, gritty, and occasionally pebbly. A large proportion of the beds are soft, friable, and easily weathered.

The marly beds are frequently laminated, strongly current-bedded, and highly coloured in alternating purple, mauve, and red tints; in some cases, however, stratification is practically absent, and the beds break down on weathering into rubbly masses with conchoidal fracture. Occasionally, the beds are mottled in pale green. Small white calcareous nodules, up to half an inch in length, are sometimes scattered through or regularly bedded within the marls, and at other times thin beds of coarse nodular limestone appear. These larger nodules range up to 3 inches in length and often exhibit highly symmetrical concretionary forms.

The sandstones and grits are usually very friable, particularly on exposure, but when fresh they may be hard and flaggy; moreover, they are

calcareous and felspathic, although to a variable extent. The grains of quartz and felspar are generally subangular to angular, and examples of complete rounding have not been observed.

The sandstones are not infrequently pebbly, but the pebbles rarely exceed 1 inch in length. Red marl is frequently included in these white sandstones, either as rounded or ellipsoidal lumps up to 6 inches in length, or as rows, beds, or masses of pellets ranging up to 1½ inches in diameter.

On a fresh fracture the white sandstones and grits may often be seen to be current bedded on a small scale, and the different laminae then show alternations of colour between white, pink, and pale mauve. The upper beds as a whole tend to become lighter in colour and more arenaceous as they are followed towards the exposed top of the series.

The red marls and the white sandstones usually vary between a few inches and several feet in thickness.

Limestones are of rare occurrence in the upper Dinosaur Beds, where they exist only as small white concretions and as thin infrequent beds of red nodules, coarse and gritty.

The fossil bones and fragments occur all through the upper Dinosaur Beds, and they do not appear to be specially confined to any particular horizon or horizons; they are usually disarticulated, and often in a fragmentary condition. The greater part of the present collection was obtained by means of systematic collecting over the surface of the ground, where the bones tend to accumulate in consequence of the rapid erosion of the soft, friable sediments. Although the formation was followed along the lake plains over a total distance of more than 80 miles, the best collecting ground was found to be at Mwakasyunguti, where the first specimens were discovered; here, within a radius of about 2 miles from the village, much the greater part of the present collection was obtained. A number of excavations were made in what appeared to be promising places, but these did not yield any very satisfactory results.

3. *Northern Facies.*—As the Dinosaur Beds are followed north-westwards from the Mwakasyunguti area towards the Nkana area on the Songwe River, a gradual change in the character of the upper beds, and to a less extent in that of the lower, is found to take place. The beds become coarser and more conglomeratic, with pebbles up to 6 inches in length, more friable, and lighter in colour. Stratification becomes less obvious as differences in hardness, texture, and colour grow less marked; accordingly, in place of the strongly banded red and white upper marls and sandstones of the southern area, there appears a great thickness of pale greenish-grey sandstones, friable and pebbly, relieved only by a few bands showing slight reddish tints. These sandstones are rather more calcareous than those of the southern area. In the north, as in the south, a complete transition

may be observed between the lower and the upper groups, each of which occupies about half the total thickness of the formation.

Side by side with these changes the fossil contents of the beds become less and less, so that at the extreme north they appear to be very rare or even absent altogether.

(c) *Chief Occurrences.*

The more important outcrops of the Dinosaur Beds are as follows, in order from north to south :—

1. *Nkana Area, Songwe River.*—The Dinosaur Beds of the Nkana area comprise the " Striped Grits " of Andrew and Bailey, who considered that these beds formed the uppermost local Karroo ; * later observations by the present writer have shown, however, that in the vicinity of Makeya Gorge the " Striped Grits " transgress across faults that affect all members of the Karroo sequence, and that they are lithologically indistinguishable from neighbouring outcrops of the Dinosaur Beds.†

The outcrop of the beds gives rise to the somewhat hilly tract that is bounded by the ridge of Karroo limestone on the west and by the scarp of the Songwe Volcanic Rocks on the east (see fig. 2) ; the total width of the outcrop is about 2 miles. The beds strike about north-north-west and are continued in this direction for some miles beyond the Songwe, where, as in the Nkana area, they dip at a gentle angle beneath the volcanic tuffs. The total thickness of the beds probably exceeds 1200 feet.

The beds comprise a lower red division, making up at least half the total thickness, and an upper pale greenish-grey division with a few reddish or pink bands. The lower beds consist chiefly of a soft red clayey grit, with scattered pebbles ranging up to 1 inch in diameter, and a few thin pebble beds, together with some bands of mauve to purple grit, more or less calcareous ; the upper beds consist principally of soft friable sandstones and grits. The sequence here conforms to the northern facies as described in an earlier paragraph.

Although the outcrop is undergoing rapid erosion and thus gives rise to innumerable hills and ridges about 120 feet in height, good exposures are difficult to find owing to the very friable nature of the sediments.

2. *Mpata Area, North Rukuru River.*—In this area also the Dinosaur Beds transgress across the Karroo boundary faults on to the crystalline rocks, and they again give rise to a deeply dissected area of friable pebbly sandstones.

* " The Geology of Nyasaland," Q.J.G.S., vol. lxvi (1910), p. 202.

† " Notes on the Karroo Sequence North-west of Lake Nyasa," Trans. Geol. Soc. S. Africa, vol. xxix (1926), p. 59.

North of the North Rukuru River they rest unconformably upon the Karroo calcareous mudstones on the west, whereas they are faulted against these rocks on the east; moreover, they are in part overlain by Sungwa conglomerates and pebbly sandstones, which dip towards the east-north-east and present bold scarps on the western and southern sides. South of the North Rukuru the Dinosaur Beds are faulted down between crystalline rocks for some miles along the Yomburu Valley, where they are overlain by patches of Tertiary sediments. In the upper Mwesia Valley (fig. 1) the Dinosaur Beds rest unconformably upon the upper Karroo over a considerable area, and here they have yielded a small collection of fossil bones; these are the beds shown as "Recent" on Andrew and Bailey's map.*

3. *Mwakasyunguti Area.*—This is the most important part of the whole outcrop of the Dinosaur Beds, both because of its extent and because of the very satisfactory collection of fossil bones it has yielded. Here the outcrop is bounded on either side by crystalline ridges; it is fully 2 miles in width, but this is due to several strike-faults, the most important of which is of pre-Pliocene age and runs down the middle of the valley, repeating the whole sequence. In a general view of the valley the dark red outcrop of the lower Dinosaur Beds is easily distinguished from the lighter coloured and banded outcrop of the upper beds. On the west the beds are sometimes faulted against the crystalline rocks and sometimes laid upon them, whereas on the east they dip for a short distance beneath a high scarp of Chiwondo Beds capped by Chitimwe conglomerate, and then are faulted against the crystalline ridge. Further southwards almost the whole of the floor of the valley is occupied by the lower beds.

4. *Florence Bay Area.*—Here the Dinosaur Beds comprise the "calcareous sands" of Andrew and Bailey;† they have yielded many very fragmentary and much-weathered fossil bones.

The upper beds rise to a height of 800 feet above Lake Nyasa, and at a point on the Florence Bay road, about 7 miles from Livingstonia, they are seen to be faulted against the crystalline rocks. Farther to the north-east the lower beds rest upon the Karroo sandstones of Lion Point ridge. The beds are overlain by a patch of red gravels belonging to the Chitimwe Beds.

III. Relation of the Nyasaland Dinosaur Beds to those of Tanganyika Territory.

The Dinosaur Beds of Tanganyika Territory are included within the Tendaguru Series, which constitute the transition beds between the Upper Jurassic and the Lower Cretaceous; the Tendaguru Series, which com-

* Q.J.G.S., vol. lxvi (1910), p. 206.

† *Op. cit.*, p. 224.

prises estuarine and marine sediments, lies north-west of Lindi at a distance of 350 miles east of the Nyasaland Dinosaur Beds (see fig. 4). While the Tendaguru Series is confined to the eastern part of the Territory, the beds that succeed it—namely, the Makonde Beds, of terrestrial origin—are known to extend several hundred miles inland from the coast.* Moreover, I

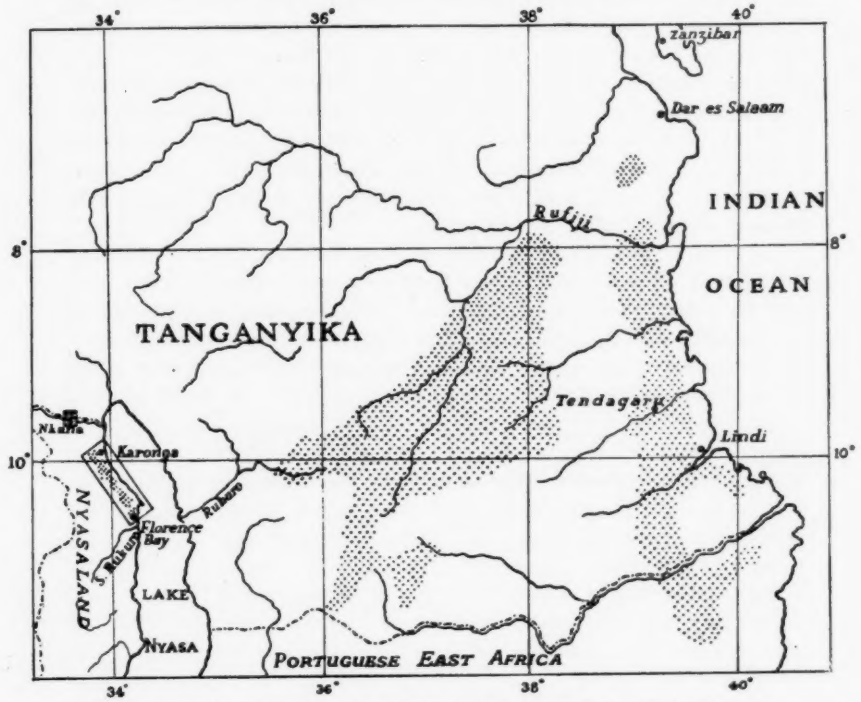


FIG. 4.—Sketch-map to show the relation of the Dinosaur Beds of Lake Nyasa to the late Jurassic and Cretaceous rocks of Tanganyika.

understand from Mr. C. Gillman, of Tanganyika Territory, that these beds extend as far west as the Ruhuhu Valley, where they rest unconformably upon Karroo sediments at a distance of less than 100 miles from Lake Nyasa and at an elevation of 830 feet above it; they thus stand at about the same height above Lake Nyasa as do the Nyasaland Dinosaur Beds. The Karroo rocks occupy the floor of the valley at this point, and they descend thence as a broad continuous outcrop down the valley as far as the shores of Lake Nyasa. In view of these relations between the Karroo

* J. W. Gregory: The Rift Valleys and Geology of East Africa, sketch-map, p. 275.

and the Cretaceous in the Ruhuhu Valley, together with the fact that the Nyasaland Dinosaur Beds rest upon broad platforms opened out on the non-resistant Karroo sediments, it appears highly probable that these Cretaceous rocks formerly extended down the Ruhuhu Valley at least as far as the shores of Lake Nyasa.

There is reason to believe that the earlier Rift Valley movements in the Lake Nyasa region took the form of gentle northerly and north-north-westerly folds, and that the Nyasaland Dinosaur Beds were laid down in a depression formed in this way.* These folds diverted a large part of the pre-existing west-east drainage, but the Ruhuhu,† being better established than the other rivers owing to the erosion of its bed along the outcrop of relatively soft Karroo sediments, was able to maintain its course to a much later period, probably until it was finally intercepted by the Nyasan rift-faulting of early middle Tertiary times.

In view of these considerations, combined with the probable former extension of the early Cretaceous sediments down the Ruhuhu Valley, it is difficult to avoid the conclusion that the river or rivers that were responsible for the accumulation of the Nyasaland Dinosaur Beds escaped to the sea of that period by way of the Ruhuhu Valley, and thence eastwards to the site of the deposition of the Tendaguru Series.

* F. Dixey: "The Nyasaland Section of the Great Rift Valley," Geog. Journ., 1926, p. 117.

† J. W. Gregory: The Rift Valleys and Geology of East Africa, London, 1921, p. 306.

ON SOME REPTILIAN REMAINS FROM THE DINOSAUR BEDS OF NYASALAND.

By S. H. Haughton, D.Sc., F.G.S.

(Published by permission of the Hon. the Minister for Mines and Industries.)

(With Plates II–V and two Text-figures.)

As a result of his field work in the Mwakasyunguti area of Nyasaland, Dr. F. Dixey sent for identification and description a large consignment of bones of Sauropodous Dinosaurs. Examination of these bones has proved disappointing. Nearly all of them are weathered and fragmentary, and in very few instances was it possible to fit pieces together in order to make fairly complete bones. There are numerous vertebral centra, mostly from the tail region, several parts of humeri, of femora, and of tibiae, and fragments of ilia. The fragments indicate the presence of several animals of differing size; but, except in one instance, where several bones were found in association, there is no evidence from the field as to the relationships of the various finds. Except in the one case mentioned, it seems unsafe, therefore, to attempt specific identification, especially in view of the mass of material from the neighbouring Tendaguru area which yet awaits publication, and with which it is probable the Nyasaland forms can most closely be compared. The procedure has therefore been adopted of figuring some of the bones, without naming them, in the hope that interest may be aroused in the discovery, and arrangements made for further and more extensive systematic search.

Dr. Dixey's collection contains nothing so gigantic as the bones of *Brachiosaurus*, but they are full of interest as being evidence of the presence, in the beds which yielded them, of a land fauna comparable with that occurring at, or near, the Jura-Cretaceous boundary in the former German East Africa and in Madagascar. The incomplete Chelonian carapace and plastron described in this paper is the first Chelonian from beds of this age in Africa.

DESCRIPTION OF FORMS.

Testudinata.

Platycheloides nyasae, gen. et sp. n.

One of the most interesting specimens collected by Dr. Dixey is the weathered carapace and plastron of a small Chelonian, preserved in a coarse brick-red sandstone which came from the Sauropod-bearing beds of Mwakasyunguti.

The chief features of the specimen can be discerned from the figures. The plastron is almost smooth. The bridge is short. The entoplastron is elongate-rhomboidal in shape. The mesoplastra are small and placed laterally. The marginal bones bear the same relation to the plastron as in *Pelomedusa*. The hinder end of the humeral scute lies well behind the posterior corner of the entoplastron, as in *Pelomedusa*, but the plastron differs from that of *P. galeata* in not possessing a median fontanelle.

The hypoplastron meets the seventh marginal bone in a suture. The inguinal buttress is fairly strong.

The chief measurements are—

Length as preserved	125 mm.
Probable greatest length	about 175 ,,
Greatest breadth	160 ,,
Length of humerals in the middle line	35 ,,
,, pectorals ,, ,,	25 ,,
,, abdominals ,, ,,	19 ,,
,, femorals ,, ,,	27 ,,
,, bridge	61 ,,
,, entoplastron	39 ,,
,, hyoplastron in the middle line	(41) 39 ,,
,, hypoplastron ,, ,,	(38) 40 ,,
,, mesoplastron	28 ,,
Breadth of entoplastron	23 ,,
Greatest breadth of right hyoplastron	69 ,,
,, ,, ,, mesoplastron	27 ,,
,, ,, ,, hypoplastron	64 ,,

It is somewhat difficult to estimate the exact systematic position of this form. The presence of mesoplastra places it definitely either in the superfamily *Amphichelydia* or in the *Pleurodira*. In the former mesoplastra are always present; in the latter they may be present or absent.

The Amphichelydia were represented in Upper Jurassic times; in Europe by *Pleurosternon* and *Platychelys*, in North America by *Glyptops*

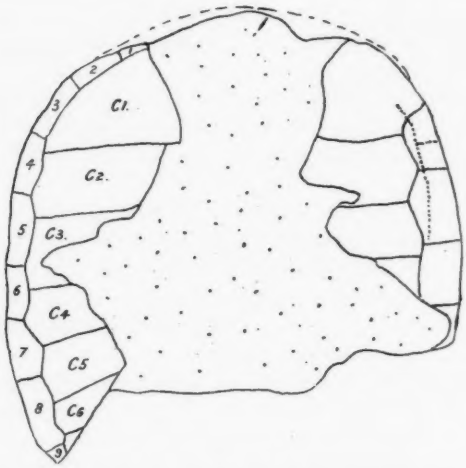


FIG. 1.—Carapace of type of *Platycheloides nyasae*, gen. et sp. n.

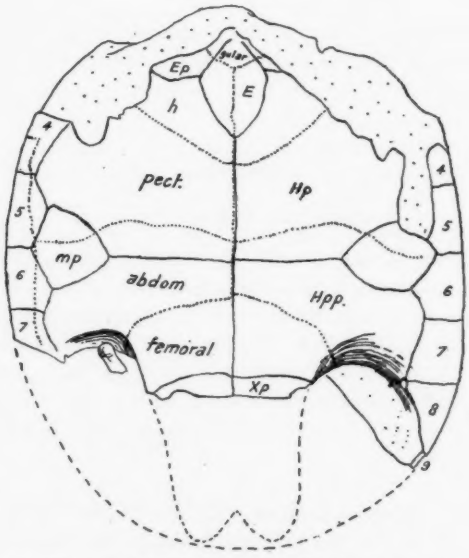


FIG. 2.—Plastron of type of *Platycheloides nyasae*, gen. et sp. n.

and *Probaëna*. The Pleurosternidae, to which *Pleurosternon* and *Glyptops* belong, have the inguinal buttresses feebly developed, and the mesoplastra meeting broadly in the mid-line and separating the hyoplastra from the hypoplastra. In *Probaëna sculpta*, regarded by Hay as an ancestral Baënid, there is a considerable fontanelle between the inner ends of the mesoplastra. *Platychelys* (from the Upper Jurassic of Europe) agrees with our form in that the mesoplastra do not meet in the mid-line, but it has a highly sculptured carapace.

It must be noted that the relations of the mesoplastra are not considered by Hay as of generic importance; his figure of the type of *Baëna riparia* shows that species to differ from the other members of the genus in having mesoplastra which do not meet one another.

The Pleurodiran genus *Podocnemis* agrees with our form in the possession of small lateral mesoplastra, but it differs in that the humero-pectoral sulcus cuts the entoplastron in the Tertiary genus. The earliest pleurodires described occur in the Upper Cretaceous of North America and were placed by Baur in the family Bothremydidae. These also possess small mesoplastra as in the Pelomedusidae. Hay points out that these probably descended from some primitive Pleurodiran ancestor close to the Amphichelydia; and the discovery of this form *Platycheloides* in Nyasaland, containing as it does features common to both the Amphichelydia and the Pleurodira, is one of great interest.

There are in the collection two other fragments of plastra, one indicating an animal larger than the one here described, but both are too fragmentary for effective description.

Sauropoda.

Gigantosaurus dixeyi, sp. n.

According to Dr. Dixey, certain bones were found in contact with one another, or were within two or three feet laterally of one another. These bones proved to be a right pubis, an anterior caudal vertebra, half of a cervical vertebra, an incomplete scapula, and two plate-like bones which can only be interpreted as sternal plates. With the exception of the cervical vertebra, it is probable that these bones are part of a single skeleton, and they will be described as such. They are numbered 7405 in the South African Museum Collection.

Caudal Vertebra.—Comparison with the series of tail-vertebrae of *Camarasaurus* figured by Osborn and Mook (1921) shows that this specimen comes from the anterior part of the tail, and probably from the region occupied by the 7th to 10th caudals. The centrum is procoelous, much more

markedly so than in *Camarasaurus*. The lower surface is somewhat flattened.

The chief measurements are—

Total height of vertebra	244 mm.
Spread of caudal ribs (estimated)	202 ,,
Total length of centrum	95 ,,
Anterior width of centrum	124 ,,
,, height of ,,	116 ,,
Posterior width of ,,	108 ,,
,, height of ,,	112 ,,

Compared with *Camarasaurus* the centrum is thus much more robust in this Nyasaland form.

The spine is of moderate height, broadened at the summit, where it is rugose, and sloping slightly backward. Its antero-posterior diameter is relatively greater than in *Camarasaurus*. Its anterior face has a strong median ridge, and two lateral ridges which arise at the prezygapophyses and die out superiorly. The posterior face is a deep vertical broad groove flanked by postzygapophysial laminae.

The postzygapophyses face largely outward and slightly downward. The transverse processes have strong bases, are fairly short, and curve outwards and backwards.

Compared with the anterior caudal of *Barosaurus robustus* (Fraas, 1908) this vertebra shows some points of similarity. The convexity of the posterior face of the centrum is about the same in the two forms, but the dorsal spine is broader and heavier—according to information given me *in litt.* by Professor Janensch ; and the centrum is much longer in relation to its width than in the Tendaguru form. Moreover, the Nyasaland bone is considerably smaller. There are also certain resemblances to the bone figured by Thevenin as the 2nd caudal of *Bothriospondylus madagascariensis*.

Scapula.—There are two portions of a right scapula, forming a fairly complete bone with the exception of a short length of the shaft and the anterior process of the proximal end.

The measurements are—

Greatest length	prob. 660 mm.
Length of glenoid surface	135 ,,
Maximum thickness of shaft	43 ,,
Minimum width of shaft	about 120 ,,
Width of proximal end as preserved	220 ,,

The bone is relatively longer and more slender than that of *Camarasaurus*. The posterior side of the shaft is thicker than the anterior, the

posterior outer side having a prominent longitudinal swelling in the lower half. The inner surface of the blade is flat dorsally, and concave in its lower half. The posterior border differs from that of most of the other described Sauropods in the possession of a prominent short supraglenoid spine which lies on the inner side. This spine is indicated in the figure of the scapula of *Brachiosaurus fraasi* described by Janensch. The hinder border of the shaft is less straight than in *Brachiosaurus*.

As far as comparison is possible, the bone differs from that figured by Fraas as a scapula of *Gigantosaurus* sp. in being more slender.

Sternal Plates.—A number of plate-like fragments have proved to belong to the sternal plates, and have been fitted together to form a pair of nearly complete bones. The plates approximate more closely in shape to the elongate form displayed by *Triceratops* and *Monoclonius* than to the more rounded plates of *Brontosaurus*.

The greatest length of the more complete bone is 510 mm., the greatest breadth about 300 mm. The inner edge is thin and straight, the outer edge convex and thicker. The outer anterior corner of the bone is strongly thickened for articulation with the coracoid, with a broad rounded ridge on the ventral surface. The anterior end is the broadest part of the bone. The posterior edge is but slightly thickened, and is somewhat irregular.

Sternal plates have not been described from the Sauropod material of Tendaguru, but these plates show certain points of similarity with those of *Diplodocus* as figured by Hatcher (1906).

Pubis.—The right pubis is fairly complete, lacking the ischiac prominence at the proximal end. In general appearance it is typically Sauropodous, but slightly lighter in build and longer than the pubis of *Camarasaurus* or of *Diplodocus*. The maximum length is 595 mm., the breadth at the distal end 197 mm., and the maximum thickness of the distal end 52 mm. The shaft is somewhat slender, expanding considerably distally, but not thickening to any great extent. The proximal end is imperfect. The inner surface of the bone is flat; the outer surface has a strong rounded ridge passing downwards and forwards from below the large oval pubic foramen. The bone is less elongate than the pubis of *Dicraeosaurus*.

The fragmentary nature of these remains and the incompleteness of the hitherto described Sauropods of the Tendaguru region make accurate comparisons impossible; but the ascription of these bones to the genus *Gigantosaurus* Fraas is not an impossible one, and it is proposed therefore to make them the type of a new species, which can be called *G. dixeyi*, sp. nov.

It must not be overlooked, however, that—as far as comparisons are possible—the form shows points of similarity with the genus *Titanosaurus*. According to the latest review of the Sauropoda (von Huene, Mem. Queensland Mus., ix, 1927) the family Titanosauridae is characterised by the

following features among others: "First caudal biconvex, the following caudals procoelous. Neural arch in middle and posterior caudals fixed only in anterior part of centrum. Two long, narrow sternal plates. Pubis broad plate in whole length with small foramen. Processus lateralis in humerus only little prominent." The bones under discussion could be fitted into this definition; we are promised far more knowledge of the Titanosauridae in a forthcoming paper by von Huene on the Sauropods of Patagonia. *Titanosaurus* is already known from the Lower Cretaceous of Madagascar, and it would not be surprising to find such a widespread genus occurring in Nyasaland.

Sauropoda gen. incert.

Caudal Vertebrae.—There are several weathered centra of caudal vertebrae which agree with *Gigantosaurus* and *Titanosaurus* in being markedly procoelous. They differ from the vertebra of *G. dixeyi* in being longer in proportion to the height, and in having a larger neural canal. At least four of them come from the anterior part of the tail, as the centra carry transverse processes (caudal ribs). The centra are not pleurocoelous; the neural arches arise from the anterior half or two-thirds of the centrum, leaving the posterior half or third bare. In the more anterior centra the upper surface of the transverse process passes directly into the side wall of the neural arch, as in the figured specimen of *G. dixeyi*; in those further back, it is separated from the wall of the arch by a distinct groove.

From the variation in size presented by these vertebrae, it is probable that they are parts of more than one skeleton, and possibly of more than one form. But their specific identification is a matter of great difficulty, partly because of their incompleteness, and partly because of the lack of description of the corresponding parts of named species.

Humerus.—The largest and most complete humerus in the collection (S.A.M., Cat. No. 8735) is in two parts, which almost fit together. It was whole in the field, but, according to Dr. Dixey's notes, the central part of the shaft was so decayed that it crumbled away and could not be collected. There cannot, however, be much missing from the shaft. The proximal articular surface is also not present.

The approximate measurements of the bone, which is a left humerus, are—

Length	990 mm.		
Breadth, proximal end	330 „	(33 per cent. of length)	
„ distal end	270 „	(27·5 „	„)
Minimum breadth of shaft	115 „	(11·6 „	„)

Thus, although the ends are more greatly expanded than in *Brachiosaurus brancai*, the proximal end bears to the length nearly the same relation as in *B. altithorax*; and the humerus is definitely of the Brachiosaurid type and not of the short type seen in *Camarasaurus* and in *Gigantosaurus*. The bone displays marked similarity, too, to the humerus of *Titanosaurus australis* figured by Lydekker.

The deltoid crest is not very massive, but it stands at right angles to the main plane of the face of the bone, so that the muscular fossa is very deep. Near the proximal end of the inner face of the bone there is a prominent rugosity which passes distally into a low rounded ridge which dies away above the middle of the bone.

The distal condyles are distinct and rounded; the groove separating them is wide and shallow. On the posterior face, the distal half of the bone shows the same broad longitudinal depression as is seen in *Titanosaurus australis*.

This bone came from an horizon about 150 feet higher than the type of *Gigantosaurus dixeyi*.

The proximal half of a slightly smaller right humerus (Cat. No. 8736) shows the articular surface and head of the bone. The maximum width of this bone is 270 mm., while the maximum thickness across the articular surface is 100 mm. In end view the anterior edge of this surface is regularly concave; the posterior edge is saddle-shaped. The contour of the proximal end differs somewhat from that of *Titanosaurus australis*, and approximates more to that of *Brachiosaurus*.

Femur.—The most complete femur in the collection lacks the proximal end, and has the distal condyles somewhat weathered. It is, moreover, considerably flattened, so that the shaft is now much thinner than it must have been in life.

The bone is from the right side. Its greatest length was probably about 102 cm., its present length being 85 cm. The distal width as preserved is 24 cm., and the minimum width of the shaft 16·5 cm. The middle of the fourth trochanter was about 65 cm. above the bottom of the bone, the trochanter thus being higher on the bone than in *Amphicoelias*, with which it agrees in the slenderness of its proportions.

The proximal end of another femur indicates a bone of much greater size than the foregoing. Its maximum width is about 39 cm., and the probable length of the whole bone, therefore, would have been about 136 cm. If the largest humerus and the largest femur can be considered as bones of the one species—and there is no field evidence in support of, or against, such a view—then we must recognise a form in which the forelimb was very considerably shorter than the hind-limb, a form far removed from *Brachiosaurus* and closer to *Gigantosaurus* or to *Barosaurus*.

EXPLANATION OF PLATES.

Plate II.

Right pubis of *Gigantosaurus dizeyi* sp. n.

Fig. 1. Internal view.
Fig. 2. Posterior view.
Fig. 3. External view.

Platycheloides nyasae, gen. et sp. n.

Fig. 4. Carapace of type.
Fig. 5. Plastron of type.

Plate III.

Caudal vertebra of *Gigantosaurus dizeyi* sp. n.

Fig. 1. Anterior view.
Fig. 2. View from right side.
Fig. 3. Posterior view.

Plate IV.

Fig. 1. Sternal plate of *Gigantosaurus dizeyi* sp. n.
Fig. 2. Right femur of unnamed Sauropod.

Plate V.

Fig. 1. Humerus of unnamed Sauropod (S.A.M., Cat. No. 8735).
Fig. 2. Proximal end of right humerus of an unnamed Sauropod (S.A.M., Cat. No. 8736).
Fig. 3. Proximal end of a large femur of an unnamed Sauropod.

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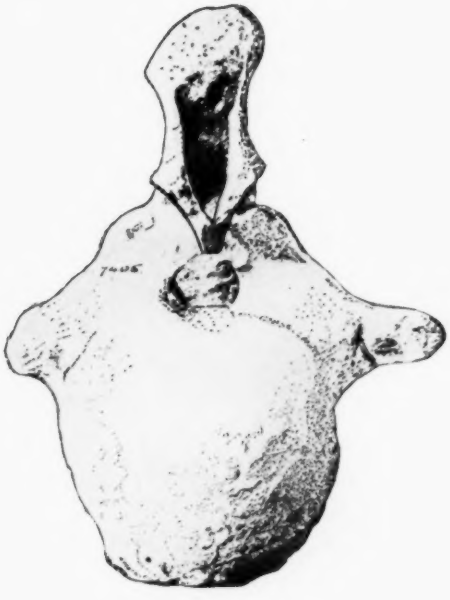

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THE ARCHAEOLOGY OF THE VAAL RIVER GRAVELS.

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(With Plates VI–XVI, Map, and nine Text-figures.)

The Vaal River gravels have long been famous for the number and interest of their implements. Perhaps the first writer to note the occurrence of implements was W. H. Penning.* He writes: "Several years ago I mapped the gravels round Barkly West, where the first diamonds were discovered, and found them divided into four terraces which mark the old courses of the Vaal River at different elevations. . . . The Vaal River gravels are made up of pebbles of volcanic rock, sandstone, and hard shale, with many pretty specimens of agate, chalcedony, and jasper of many colours, which impart a distinctive character to the deposit derived in the washing for diamonds. . . . The bed, or rather layer, of gravel in which large numbers of stone implements are embedded is only a few inches in thickness and lies at the base of the deposit which forms the first terrace above the river. It contains diamonds and very many subangular water-worn lumps of volcanic rock, of which a small proportion are roughly of the same shape as the implements, and would, therefore, have readily lent themselves to their manufacture."

It is a little difficult to identify these gravels of Penning, they are probably downstream from those mentioned by du Toit, but only three separate gravels have since been identified by the latter.†

Of the terraces in general, du Toit ‡ says: "The gravels occur at intervals on both banks of the Vaal River, sometimes at a considerable distance from the river-bed, and usually in more or less disconnected patches. The gravels are situated at various levels as well as at varying distances from the Vaal River, and though they form a number of fairly distinct terraces it is not always easy to determine their relative age. On the west

* Penning, Gold and Diamonds, London, 1901, p. 9 *et seq.*

† Péringuey, Ann. S.A. Mus., vol. viii, p. 59.

‡ Ann. Rep. Geol. Com., 1906, vol. xi, p. 171.

of the Vaal the terrace is finely developed at Klipdam, where it has an altitude of 200 feet above the river and a distance from it of three and a half to six miles." This terrace rests upon an evenly cut surface of diabase and Dwyka, falling gradually to the south. He points out that the two most important barriers of hard rock, which have held up the gravels, lie between Warrenton and Windsorton and between Barkly and Sidney, respectively. The gravels lying above these ridges are lower (relative to the bed of the present river) than those lying below these ridges.

Unfortunately it appears to be quite impossible to date these gravels in any way with our present knowledge in South Africa. Du Toit * says: "There can be no doubt that the highest gravel dates back to a period when the topography was far different to that of the present day. When the oldest gravels were in process of formation the present Harts River had not yet come into existence; since that period a broad valley has been excavated to a depth of over 500 feet." These higher gravels, however, show no signs of human life, and du Toit goes on: "In the earlier terraces I have not found any traces of palaeolithic man, but in those which are situated at altitudes of from 20 to 40 feet above the present river-beds, water-worn worked implements are not uncommon. Such occurrences have been noted by Johnson and Young † at Barkly West, Droogeveld, Schmidt's Drift, and Douglas, and there can be no doubt that man existed in these parts of South Africa at a time when the rivers had not cut down to their present levels." P. Wagner is similarly at a loss when attempting to date the gravels.‡ He states: "The data at present available are extremely scanty. Beck § has described the molar of a mastodon, and Fraas || the remains of *Equus*, cf. *zebra* Linn., *Damaliscus* sp., *Hippopotamus amphibius* var. *robustus*, and *Iridina* sp., all of which were found in a gravel terrace at Waldeck's Plant at an elevation of 70 feet above the present level of the Vaal. These fossils clearly prove the gravel deposits in question to be of Lower Pleistocene age." Haughton has also examined a number of fossils from the McGregor Museum, Kimberley,¶ and describes a portion of an elephant molar, which he regards as intermediate between *Elephas africanus* and *E. planifrons*. He calls this *Loxodonta Griqua*. He does not associate this with any gravel. He also describes a new genus, *Griqua-*

* *Op. cit.*, p. 174.

† J. P. Johnson, Trans. Geol. Soc. S.A., 1906, vol. ix, p. 53.

‡ Wagner, Diamond Fields of Southern Africa, 1914, p. 252.

§ Geol. Mag., 1906, p. 49. This tooth was determined by Felix as *Mastodon* (*Bunolophodon*).

|| E. Fraas, "Fauna aus den Diamanteifen von Sudafrika," Zeits. der deutsch. G.G., Hft. lix, 2, 1907.

¶ S. H. Haughton, "On some Fossils from ' Vaal River," Trans. Geol. Soc. S.A., 1921, vol. xxiv.

therium cingulatum, and does not associate this either with any particular gravel.

Hippopotamus amphibius var. *robustus*, he says, is "obviously more recent and presumably came from either the lower gravels or from the loam which constitutes the surface-covering of the area."

He states finally that "Although none of the fossils come from the highest and oldest of the terraces, *Mastodon*, *Griquatherium*, and *Libytherium* (all of which probably came from the sixty-foot terrace) are sufficiently removed from the existing fauna and close enough to known more northern forms to be classed as Pleistocene. Doubtless many more fossils will come to light. Care must be taken to ascertain the exact level of each find, and it should be possible in course of time to institute a palæontological time-scale for the various terraces and to attempt to correlate them with the well-defined, but little-known, high-level gravels and terraces of the belts nearer the coast." This would constitute a really valuable time-scale for archæology, and the two sister sciences are here in a position to help each other considerably.

Wagner differentiates between several gravels, and roughly the outline of his scheme is this: *

(*a*) Shallow deposits of high-level gravels over the Vaal and Harts River plain, up to 400 feet above the present level, of very considerable antiquity.

(*b*) Well-defined terraces bordering the present river-beds. At Windsorton he notes these and regards them to be of far more recent age.

(*c*) Deep gravels or deep placers, representing ancient gravel-filled river channels. Some occur in immediate contiguity to the Vaal River, others away from it and above it. (These appear at Droogeveld and at Sydney.)

(*d*) Accumulations of gravels in deep pools; these are still in process of formation.

These various gravels he regards as due to the great barrier lying between Barkly and Longlands, and numerous minor obstructions on the Lower Vaal.

Both Penning † and Johnson ‡ point out that the fact that in South Africa we tend to find "palæolithic" implements on the surface is no means of dating them. For instance, on the veld about Kimberley, *coups-de-poing* occur side by side with Later Stone Age material. "On ancient plateaux where there has been little denudation, but mostly superficial disintegration, or in extremely flat country intersected by only a few streams, stone implements of very great age may be found resting upon the present surface and affording no evidence of antiquity. But under

* Wagner, *op. cit.*, pp. 250 and 264.

† *Op. cit.*, p. 64.

‡ J. P. Johnson and R. B. Young, Trans. Geol. Soc. S.A., 1906, vol. ix.

more ordinary conditions and in more dissected areas, they will be found buried under the talus that accumulates at the foot of the hills, or in the drift that is laid down in the valley bottoms, both of which types of deposit may supply good proofs of their antiquity. The best evidence, however, is afforded by river-terraces, whose relative age is easily ascertainable."

Johnson * also notes these same gravels, but does not attempt to define the age. "All along the Vaal River there are well-defined terraces. There are usually two, the upper and older one consisting of a thick bed of gravel; the lower and newer one being, as a rule, a stratum of gravelly detritus lying at the base of a varying thickness of alluvial loam. . . . They are well exposed in the numerous pits which have been dug in search of diamonds."

Wagner † notices a similar state of affairs at Windsorton, where "the river is flanked on both sides for a distance of several miles by well-defined terraces of more recent age, which rise in places to a height of 60 feet above its present bed. On these terraces two types of deposit may be distinguished, namely, accumulations of coarse unstratified gravel spread in thick layers over shelves cut in shale and diabase, and deep gravels, up to 50 feet in thickness, occupying ancient channels of the river."

So much, then, for the geology of the Vaal River as a whole. We may thus take it that there are various gravels along the Vaal and Harts Rivers, varying in number and position. Of these the oldest are probably Pleistocene of an early period, but contain no remains of human handiwork. The terraces of middle age are later in the Pleistocene period (possibly even to be regarded as Recent). The latest (and therefore lowest) river terraces are definitely modern, and often in process of formation.

Now it is worth while noting here that a river gravel normally contains objects of greater age than itself. Implements, bones, etc., must have been already present to have been incorporated in these gravels. The finding of human artefacts in modern gravels does not necessarily imply the modernity of these implements, while on the other hand their discovery in old gravels will necessarily imply an age greater (perhaps only by a day) than that of the gravels. This fact must be remembered in our dealings with the Vaal River gravels. We may be able in time to date the earliest appearance of prehistoric man in the Union, but it will be a more difficult task to date his disappearance. By the discovery of Hippopotamus teeth and Horse teeth in the 76 foot gravels we can safely determine the fact that these gravels were deposited after the beginning of the Pleistocene (Quaternary) period. Although no human remains have so far been found in these gravels and terraces, we can presume that man appeared on the Vaal River in Quaternary times.

* Stone Implements of S.A., 1908, p. 24.

† *Op. cit.*, p. 264.

It would appear that when the oldest gravels were deposited the Vaal River had an entirely different course. It seems to have flowed through Klipdam to Barkly West and thence to have turned westward to Waldeck's Plant. The oldest gravels are thus scattered along this line. No implements at all appear to have been found by any investigators on this course, but directly the Vaal takes to a course nearly the same as the present bed, man makes his appearance.

Miss Wilman states that alleged "Bushman remains" have from time to time been sent to the McGregor Museum. These appear to have been found in the most recent gravels, and Dr. R. Broom regards them as of Bantu or Bastard origin. I have not seen the remains.

Vereeniging.

The Vaal River gravels of this region are already well known,* and Johnson does not need quoting again. At Vereeniging the Vaal has left an extensive terrace east and west of the town, consisting of gravel and small boulders. East of the town is a small pit in which quartzite flakes and chipped pebbles appear. West of the town Mr. T. N. Leslie discovered unfinished *coups-de-poing* of diabase, smoothed by the action of water. With these he found quartzite implements of rougher manufacture, probably owing to the bad material, which was coarse. These last show lesser signs of wear than the diabase specimens. In spite of Péringuey's objections, we must regard these two types as contemporaneous, and the difference as being due to material. Thus Johnson points out that he discovered unfinished specimens of chert.

With these, moreover, Mr. T. N. Leslie sent to the S.A. Museum a number of small end-scrapers, etc., of chert, jasper, agate, and quartz. Mr. Leslie states he can find no dividing line between the implements; in fact he regards the two types as contemporaneous, and is "of opinion that the sign of great age of many of the larger implements is due to weathering." Péringuey says in reply: "In the face of the Nooitgedacht and Barkly West finds, this conclusion is erroneous." A suggestion similar to Mr. Leslie's, though not so definite, is given by Johnson.† "During exceptionally heavy rainfalls gullies might sometimes be scooped out of the terrace, and afterwards gradually filled in again, during which process surface implements might become incorporated." He expresses the opinion that this filling in had not occurred at the sites of Droogeveld, Barkly West,

* See Péringuey, Ann. S.A. Mus., vol. viii, p. 62 *et seq.*; also Johnson, Trans. S.A. Phil. Soc., 1905, vol. xvi, p. 107.

† Johnson and Young, "The Relation of the Ancient Deposits of the Vaal River to the Palaeolithic Period," Trans. Geol. Soc. S.A., 1906, vol. ix, p. 54.

Vereeniging, Schmidt's Drift, and Douglas, implying that at Vereeniging the cultures are contemporaneous.

I saw this filling in of gullies actually in process of happening at the Pniel Mission Station, below the school, and at Riverton. Here material from the surface of the river bank was actually being washed down into gullies which opened out directly into the river-terraces. These sites will be mentioned in their turn.

Windsorton.

A number of implements have been sent from here to the McGregor Museum, Kimberley, by Mr. A. Wohlfahrt. The first implements appearing

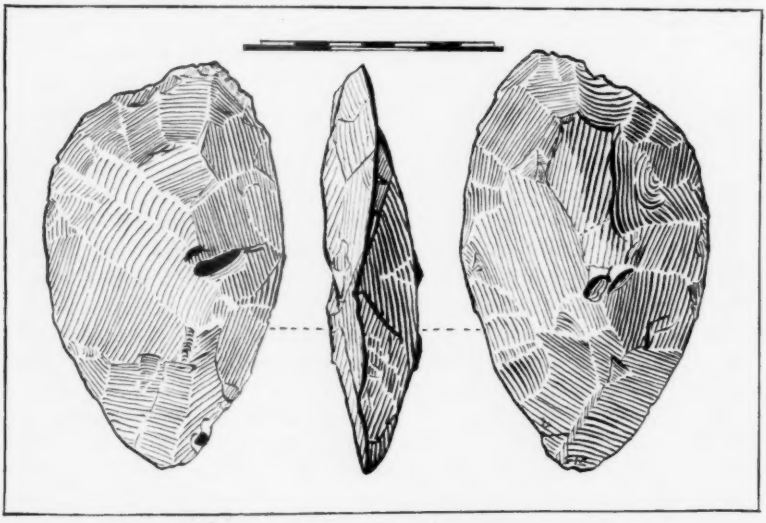


Fig. 1.—Three views of specimen M.M.K. 1415-1, Windsorton.

from here consist of some six long flakes, trimmed on either edge, either to a point at one end or left with their normal flake shape. These were found in gravels 12 feet from the surface, covered with lime. No *coups-de-poing* were associated. The flakes are some 5 to 7 inches in length, and resemble flakes of a similar type sent to the South African Museum from Haagenstad saltpan, Brandfort, O.F.S. Captain Gerton Helme also submitted similar implements from a saltpan at Haagenstad. The latter have, I believe, left the country.

Apart from this single find (M.M.K. 1183), all the finds are of the Stellenbosch type—*coups-de-poing*, *biseaux*, and discoidal artefacts. These have

been found and presented mainly by Mr. Wohlfahrt. M.M.K. 1122 is a nicely made diabase implement, a true almond shape, worked on both faces. Unluckily it has been a little spoilt at the point in the making. The length is 5½ inches. Concerning M.M.K. 1415 (Plate XII) Mr. Wohlfahrt writes: "A small box containing bouchers, which are all out of my claim from a depth of 26 to 28 feet from the surface. . . . Of course the scrapers enclosed come from the surface." It is in this type of gravel that all Mr. Wohlfahrt's implements are found. Of M.M.K. 1416–7 (Plates XII and XIII) he writes similarly (19.4.19): "The bouchers I sent you were all found by my 'boys' in an 18-inch thick layer of gravel and boulders, resting on smoothly worn Dwyka Conglomerate rock, 24 feet below the surface, which gravel layer I was working for diamonds.

"In sinking the shaft in order to get to the gravel layer, I first went through four feet of windblown red sand, and then an 18½-foot thick white river-sand layer, which is firmly cemented together by lime deposited by calcareous water. The bouchers found in this particular spot are not water-worn, as they usually are along the Vaal, and even in close proximity to this place."

Later he writes (M.M.K. 1417): "I have to-day sent you some 36 stone implements (*coups-de-poing*) which I have found in an eighteen-inch layer of gravel and boulders. . . . The gravel layer has a twenty-six-foot thick overburden of river-sand.

"These specimens appear to be of the same age; especially is this true of the last two finds. They are from sites side by side, probably within a few feet, and are from the same gravel, and from a similar depth."

The specimens (M.M.K. 1415) are of diabase, shales, quartzites, and cherts. The implements aimed at appear to be small, and the only specimen nearing a finished state is 8 inches in length. The normal variation among the fairly well-finished implements from this site is from 3 to 6 inches. Both almond and oval shapes make their appearance, but the pear-shaped *coup-de-poing* is missing. Several quite unfinished specimens are represented; these generally show that the *coup-de-poing* was made from a flake, and the cleavage plane shows on one face (Plate IX). This will be mentioned later when attention is drawn to the method of manufacture. These unfinished specimens are, of course, larger than the better finished, and the variation is from 6 to 8 inches.

Various diabase and quartzite implements appear in M.M.K. 1416, these are almond- and leaf-shaped (Plates VI and XII). Some show the cleavage-plane on one face. The better implements range between 5 and 7 inches in length.

M.M.K. 1417 shows quartzites, diabase, and shale implements all almond-shaped and in good condition. The *biseau* is also present, but it

is large, and whereas the *coups-de-poing* vary from 4 to 7 inches in length in the best specimens, this is 8 inches long. Some *coups-de-poing* show the cleavage surface on one face. A small 4-inch implement is well finished, but the point is broken.

Mr. G. Brown has also presented the Kimberley Museum with some specimens. Number 1428 is from him, and is of great interest. It is a heavily water-worn *coup-de-poing*, of rough manufacture, which has been picked up and the entire point retouched by a later hand. While the

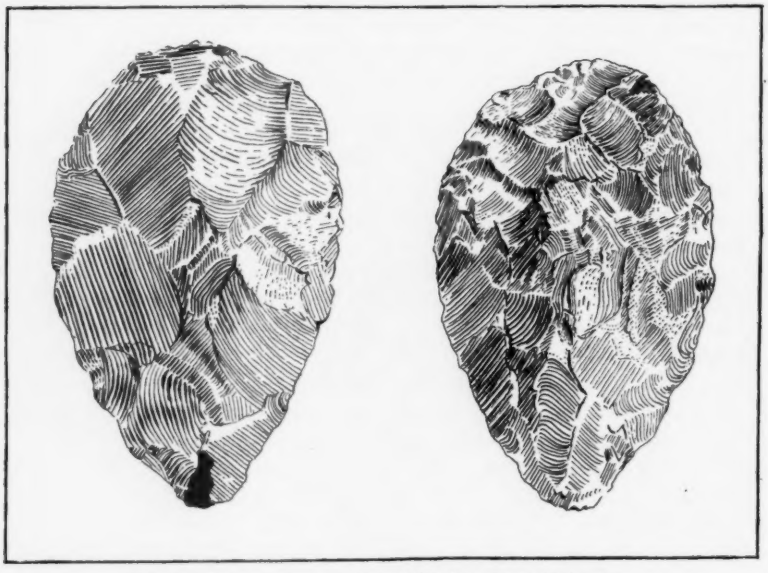


FIG. 2.—Two views of specimen M.M.K. 1417-6, Windsorton.

wear is very pronounced on the butt, the newer work is quite unworn and fresh. This would point to two facts. In the first place, it implies a long continuance of the same culture, while on the other hand it shows that the gravels were in process of formation while the industry was going on. These two facts are already shown by the accumulation of implements in more than one gravel on other parts of the Vaal.

Specimens 1472 are also from this investigator; one is an almost circular *coup-de-poing* of diabase, it is weathered, and small, measuring 4½ inches. Another is well made and of quartzite, an inch longer than the former, and almond-shaped (Plate IX).

At Windsorton Mr. W. H. Williams, who had previously made the

Waldeck's Plant discoveries, found a site on Amantia Farm. The tailings on the first terrace are full of flake tools, " below the furrow from Norden's pot-hole down the river, the alluvial sand is 4 feet deep, and the gravel about 18 inches, there are very few stone axes, and those are of a very inferior make, some hardly recognisable " (from a letter to Miss Wilman, 8th January 1927). This continues for a quarter of a mile downstream, and here the alluvial sand is 10 to 12 feet thick, and the gravels deepen to 4 to 5 feet; in this gravel he also found *biseaux* and flakes. These occur in two layers; one is at the bottom of the gravel, the other 6 inches above the bottom.

Mr. Wohlfahrt has also sent specimens from similar sites during this year (M.M.K. 1622, Plate XIV).

Riverton.

J. P. Johnson * visited this site some years ago, and describes the terraces here. " On the south side of the river, both terraces and the alluvium overlying the lower one are well developed. In the lower terrace I noticed several of the characteristic large flakes and obtained one or two of the typically palaeolithic implements. . . . Above the alluvium and gravel is a thin covering of constantly shifting sand. In places where this had been blown away I came across, in great abundance, a most interesting group of implements. Apart from hammer and grindstones, a perforated stone ball and grooved cylindrical pieces of sandstone, they may be divided into three series." He then gives three (what are now termed) Wilton groups, with pottery, ostrich eggshell beads, and possibly glass beads.

At Riverton, on the farm Tipperary, a small diamondiferous gravel was worked at the Rapids. The circumstances are very similar to those which we will deal with at Pniel Mission Station. A dam was built across the river of the larger boulders composing the gravels, and the working was carried on below this. Unluckily the river came down in spate, washing the temporary breakwater away, and digging was discontinued.

Lying about sporadically among the stones used to form the dam are to be found very rough *coups-de-poing*, *biseaux*, and discoidal artefacts. None of these are in any degree finished, and without thought one would be inclined to relegate them to " a less advanced " or " deteriorated " branch of the Stellenbosch culture. It is quite obvious that these are the remains of a workshop site which have been washed into the river-bed to form part of the gravels. The rarity of the artefacts, considering the conditions, does not allow of our passing such a judgment on the industry. The rejects fall quite easily into the range noticeable at Pniel and at Windsorton, and we have therefore no reason for supposing them to be of a coarser culture than these.

* Stone Implements of S.A., pp. 28 and 54.

While the pool above the Rapids has not been worked yet, it will very probably be found that the greater part of the workshop site is here.

The gravels are composed of diamonds, "bantams," * together with boulders and stone implements. While the bantams appear to have come from some distance up the Vaal together with the diamonds, the boulders and implements are quite local. The alluvium near the river shows similar artefacts and boulders actually in the process of being washed out, to form new gravels in the river-bed below. While these are generally confined to the dongas (erosion gullies), the whole of the higher land near by for some distance along the river is covered with end-scrapers, etc., of Smithfield and Wilton types, made from the same bantams so abundant in the diamondiferous gravels.

It was obvious to me on visiting the gravels that here the gravels and Earlier Stone Age implements were being deposited while the Later Stone Age implements were being manufactured on a slightly higher level. While the land on which the Later Stone Age material is lying has been cut by dongas, I saw no instance in which stones of this type had already reached the gravel, in spite of their high specific gravity. On the other hand the gravel contained Earlier Stone Age material throughout its depth. Mr. S. Tapscott, who acted as guide, discovered a pierced stone in a modern erosion a few feet above the present level of the river-bed. It had obviously come down from the higher land directly above it, and was thus later than the river gravel together with its enclosed *coup-de-poing* types.

The Riverton implements are of diabase, and do not often show excessive weathering. Now and then a rolled specimen appears and only the definite almond shape shows it to be an artefact. Normally, however, the flaking is easily visible, though seldom sharp. The artefacts are all amygdaloid. One specimen of a *biseau* is sufficiently advanced to show that the industry is identical with that appearing at Barkly West, Pniel, etc.

Captain G. C. Shortridge of the Kingwilliamstown Museum allowed me to make full use of his specimens from this site. These, too, had been collected by Mr. Tapscott. They are of a much better finish, and identical in industry with other Vaal River sites. The size varies from $7\frac{1}{2}$ to 3 inches in length, the average being formed thus :

11	implements	are less than 5 inches long.
7	,,	lie between 5 to 6 inches long.
4	,,	are over 6 inches long.

This shows a tendency to an implement less than 5 or 6 inches in length. While most of the specimens are made on a side-flake, one is made on an

* Or *band oms*, pebbles of banded agates, etc., of a specific gravity similar to that of the diamond.

end-flake (compare the Fauresmith industry), but this is an obvious chance, and implies nothing. No worked flakes were found with the *coups-de-poing*.

Nooitgedacht.

Miss Wilman sent a number of implements collected by Mr. J. Child from this site to Dr. Péringuey at the South African Museum, and these he speaks of in his monograph.* With the implements she sent a covering letter stating that " The Nooitgedacht implements, big and small, all occur together in a bed of gravel that is being worked on the water's edge of the river. In fact the diggers have been flooded out at times. The diggers

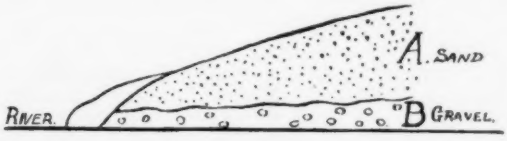


Fig. 3.—Section at Nooitgedacht.

have removed the overlying sand at A and are clearing out the gravel at B. This, then, is the lowest terrace. . . . In the sand are no implements, but lying all over the surface are some of the same type, exactly as those found in B. Large implements are not common on the surface, and some are quite unlike the water-worn rocks that they accompany."

The implements sent in were of the *coup-de-poing* type normally associated with the lower gravels. They are in an exceptionally worn condition. With these were found a number of flakes. These are described by Péringuey as " scraper-knives " and illustrated as such by him.† These specimens are now in the South African Museum, and are entirely unworked. They appear to be the normal flakes knocked off from the *coups-de-poing* in the making. This implies that the workshop site from which this gravel has been fed is not very far distant.

Péringuey continues : " In the Nooitgedacht gravel bed numerous potsherds were found associated with the implements. One piece now in the (South African Museum) collection is of moderately close texture ; the greatest thickness is 8 mm. ; and the edge of the fracture is not abraded in the least, and the outside glaze is wonderfully well preserved. There is nothing to differentiate it from the pottery made by ' Topnaar ' Hottentots (*Vulgo*, Strand Loopers). This . . . points to the implements having been deposited in their already abraded condition."

* Ann. S.A. Mus., vol. viii, pp. 56–57.
† *Op. cit.*, pl. xiii, fig. 105.

It is difficult now to see exactly how the terraces originally lay, as the workings have been abandoned and have upset the site to a tremendous extent. The fact that this pottery was discovered in association with the implements is quite fortuitous, and no other case is known of pottery of this type being associated with *coups-de-poing*, whereas it is associated with the Later Stone Age cultures throughout South Africa.

Pniel Mission Station.

A hundred implements in various stages of manufacture were brought to the McGregor Museum by Miss Wilman, Captain G. C. Shortridge, and

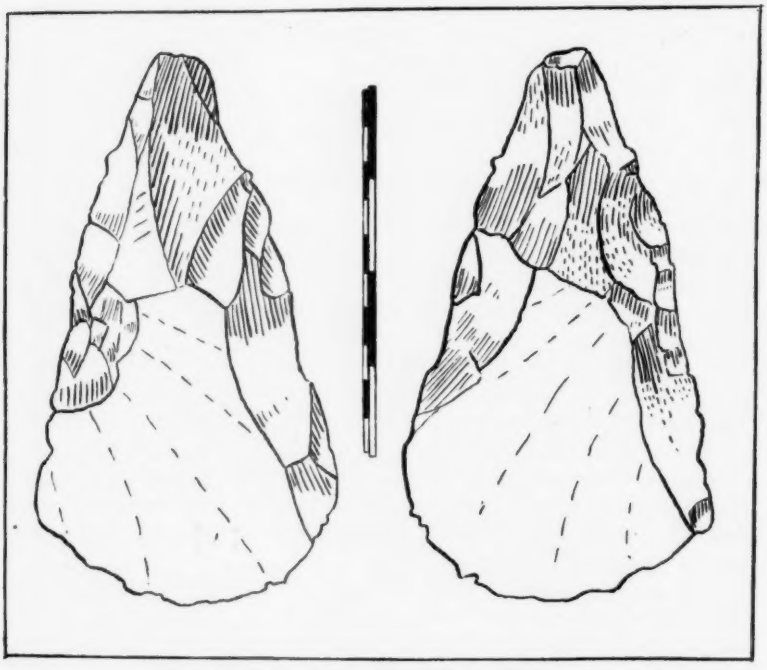


Fig. 4.—Two views of specimen M.M.K. 1618, Pniel.

the writer. These specimens have been divided between the various museums thus represented. Close to the Mission Station, which lies some 2 miles from the Kimberley-Barkly West road, some few hundred yards below the old church and school, extensive alluvial diamond diggings were started some years ago. The position is very similar to that obtaining at

Riverton. The alluvium lies in the present bed of the river, and in order to work it, a breakwater or rough dam of stones was built above the diggings and work continued in the river-bed. In the workings scattered through the depth of the alluvium were found large numbers of *coups-de-poing*, *biseaux*, and discoidal artefacts (" fabricators "), and these were incorporated in the breakwater. The fact that the greatest accumulation of *coups-de-poing* occurs on the surface of the breakwater points to their having been found right through the gravels. The implements found vary considerably and appear to represent a workshop site. The variation between the sizes of the implements is also extreme, the longest (a narrow pear shape) being 11¼ inches (29 cm.), the shortest (almond-shaped) is 3¾ inches (9 cm.) (Plate X). The normal variation, however, is much less, lying between 8½ and 4½ inches (22 and 12 cm.), while the shape tends to the amygdaloid.

A peculiar triangular *biseau* * is common from this site, and would appear to the writer to represent a stage in the manufacture of the *coup-de-poing* rather than a definite implement in itself. Specimens of this type were also recovered and sent to the three museums represented. The method of manufacture is the same at this site as at other Vaal River sites.

A few flakes were discovered at Pniel, and one or two of these are slightly worked. There is no attempt at any conventionalised implement, however, and some appear to be broken fragments from *coups-de-poing*.

Lying near to the breakwater are a large number of green chalcedony implements, flakes, rejects, and cores of the Smithfield culture, and these might at first sight appear to be associable with the *coups-de-poing*. This is not so, as the river material has been built up by the diggers into its present position during the last twenty years, while the chalcedony implements are still in process of washing down the hill to the same position. It is easy to follow the course of these implements, as much of the erosion which has caused the implements to wash in this direction is due to the road trodden by the diggers from the Mission. This has broken into gullies, and carries the implements from the foot of a dolerite hill behind the present school, and apparently from a few scattered sites between this and the river. They are definitely of a later date than the Stellenbosch types found in the river.

It is interesting to note that the chalcedony is not local, but is a part of the detritus or moraine left by the South African glacial period, which du Toit † and Coleman ‡ regard as belonging to the carboniferous period of the palaeozoic, and is not (as another writer appears to suggest) in any way comparable with the European glaciations.

* *Cf.* Péringuey, *op. cit.*, pl. viii, fig. 53.

† " The Carboniferous Glaciation of South Africa," Trans. Geol. Soc., Oct. 1921, p. 188.

‡ Ice Ages, London, 1926.

One other find (M.M.K. 1085) is from Pniel, but little is known except the fact that the implements are from the Pniel Estate, near Bester's. The implements are rough, and only three are present. One is of quartzite of

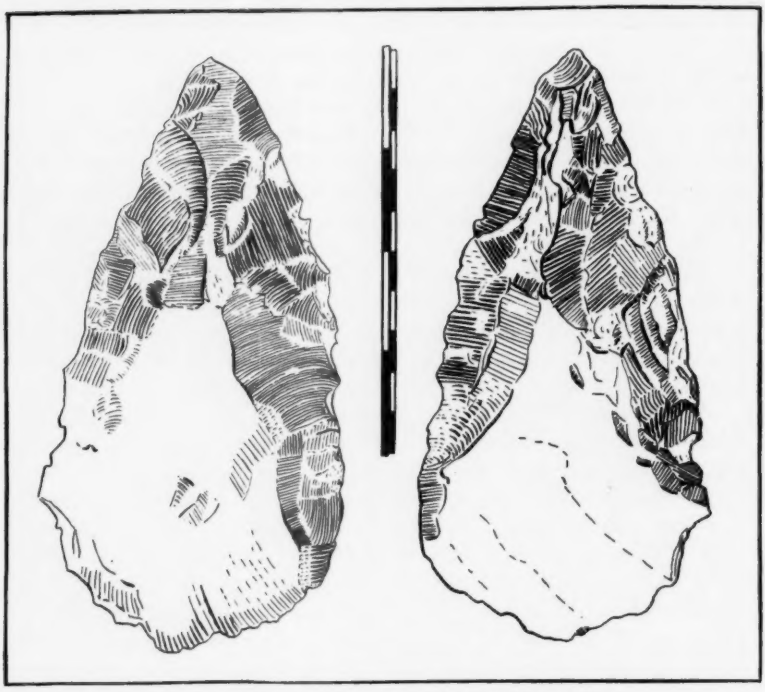


Fig. 5.—Two views of specimen M.M.K. 1597·4, Pniel.

a coarse type. The second is amygdaloid and of black quartzite, 4 inches long. The third is 5 inches long and ill-worked. While the usual implements from Pniel have weathered a blue grey, these have weathered brown, perhaps owing to the difference of material, or to difference of surrounding soil.

Barkly West.

This field is already well known owing to the works of Johnson, Penning (already quoted), and of du Toit, through Péringuey. The writer was enabled, through the generosity of the Barkly West Council, to make a further search for implements and facts.

Writing in his two books, Johnson * states: "At Barkly West on the Vaal River, between the bridge and the village, there is a terrace in which numerous pits have been sunk by diggers in search of diamonds. It lies at the foot of a ridge of hills, hence the talus element is predominant, though the river gravel is in evidence throughout. The deposit consists chiefly of small boulders and large irregularly shaped stones, in which, however, every edge and corner has been worn off.

"The most remarkable feature of the bed is the extraordinary abundance in it of the typical palaeolithic implements and the associated large flakes; in fact they form an important constituent of the deposit. These frequently occur on the tops of the heaps of excavated stones and hence come from the bottoms of the pits, a distance of about 10 metres." From the evidence he found there, he came to the conclusion that there are two periods represented, one consisting of worn, ill-made implements older than the terrace, the other being later and consisting of sharply defined and better-made implements, contemporaneous with or later than the gravel. He also (I think quite wrongly) suggests that "Professor Beck of Freiburg has recorded the discovery of a fragmentary molar of a mastodon in the corresponding terrace on the other side of the river" (at Waldeck's Plant, some miles down the river). He is here under the impression that this terrace (a 30- to 40-foot terrace) was the highest river terrace, but du Toit later pointed out that there was a higher terrace lying above the present diggings at Canteen Kop, on the Nek near the present water reservoir.

Writing to Dr. Péringuey,† he says: "There are several old river terraces in the neighbourhood of Barkly, one immediately above the present river-bed, and a second from 30 to 40 feet above it, as recorded by Messrs. Johnson and Young. . . . This higher terrace is indicated at A, on the accompanying figure. . . . At B there is a gap in the hills, through which a loop of the Vaal very probably flowed in former times, C being then an island.

"Traces of still older gravels are found on the tops of the ridges C and D about 100 feet higher up; but to the north this terrace is continuous and well developed, but does not appear to carry any large implements. . . . This middle terrace of Barkly (which therefore corresponds to the 'Upper' of the two authors quoted) carries many rolled implements; at the point marked A they have been brought up in thousands. Among the inclusions of diabase . . . are numerous well-shaped implements, considerably water-worn, their abundance at this one spot being most remarkable.

"It seems most likely that the implements were manufactured on the slopes of the little hill marked C, and that they gravitated down into the

* The Prehistoric Period in South Africa, 1910, p. 26; also The Stone Implements of South Africa, 1908, p. 25.

† Péringuey, *op. cit.*, p. 59.

river at A ; at the time when this terrace was formed there would probably be an eddy at A, where the two branches of the river united, and this might account for their extremely rolled condition, and possibly for their concentration at this point."

The spot marked A (Canteen Kop) is still being worked for diamonds, and the writer was able to recover a few specimens of the *coup-de-poing* and *biseau* type, exactly similar to other Vaal River specimens (S.A.M. 4536). There appears to be no indication present to account for the division into two types noted by Johnson at this spot. The site I visited was on the

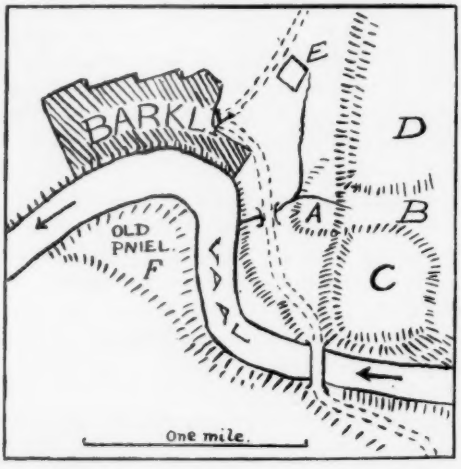


Fig. 6.—Map of Barkly West, after Péringuey.

crest of Canteen Kop, and the implements were mixed with boulders to a depth of 24 feet. There is an overburden of 6 feet of red sandy soil, apparently wind-deposited, lying over an 18-foot layer of boulder gravel, which rests upon shale. The implements are mixed up with the gravel.

There appear to be indications of other sites at Barkly. When examining the north (Barkly) bank of the river, I discovered a single specimen of a well-made *coup-de-poing* firmly wedged under the corner of a rock. It was distinctly visible on three sides, but immovable. There are thus likely to be implements in the alluvium on which Barkly now stands. So far as it is possible to see, there are no actual river gravels at this point. Behind the town (at the spot marked E on the map) there are several surface diggings about the cemetery. The gravel is very thin here, varying from 2 to 6 feet, and no implements at all appear from this part. The only local stone is diabase ; this is coarse and disintegrating.

Of the implements from Barkly West, a few have been sent in from the Canteen Kop site. Father Yves Tournellec has presented about a dozen specimens (M.M.K. 934). These are of chert, quartzite, and diabase. They are mostly rough and water-worn, varying in length from 5 to 8 inches. The quartzite specimens are very much less weathered than the others.

Other specimens sent by him (M.M.K. 728, Plate XVI) are of diabase and chert, and while they are fairly well weathered, the fractures are still easily visible. The better-shaped implements are small (3 inches) and tend to be oval or almond in shape. The larger artefacts, up to 7 inches long, are coarser. Both large and small artefacts show the cleavage surface on one or both faces in the less-finished specimens.

Several other groups of implements have been sent to the McGregor Museum from sites at Barkly West. Mrs. R. K. Granger submitted specimens of dolerite, quartzite, chert, and diabase. Some of these are small, 4½ inches long, and tend to be slender. The almond and leaf shapes predominate and are of a normal type. The weathering varies widely, some appear fresh and new, while others are considerably worn.

While the working in the earlier stages of manufacture is coarse, this tends to fine down considerably in implements of 6 or 7 inches in length, showing that this was the size of implement and fineness of workmanship aimed at. Some of the larger and badly finished specimens show the cleavage surface over almost the whole face, showing the method of manufacture.

A single chert implement (M.M.K. 1418) is interesting, as it was apparently an excellent almond shape when made, but has received a number of heavy blows along one edge since then, cutting away almost a half of the original implement and giving it a peculiar appearance. The specimen is some 6 inches long, and comes from a surface site in red soil at Barkly West.

Mr. J. A. Swan has sent in a single diabase specimen from Barkly West from deep gravels, probably the same as those mentioned by Johnson, as they were sent in while the same diggings were being worked (1911). This is water-worn and fairly rough.

Péringuey, in a footnote,* states that " in the Bloemfontein Museum are two bouchers of large size, bearing the inscription : ' Found 40 feet deep in the old course of the Vaal River at Barkly West.' It is possible that these implements were collected by either Stow or C. Sirr Orpen at the very spot mentioned by du Toit." I did not see the specimens when visiting Bloemfontein, and can give no further information on that point.

* Péringuey, *op. cit.*, p. 75.

Old Pniel.

Across the river is Old Pniel (F, fig. 6), full of historical interest, as it was here that both Cecil Rhodes and John X. Merriman began their digging in the "Early Days."

Through the kindness of Mr. G. Barrell, Mayor of Barkly West, I was enabled to visit the old diggings which lie directly opposite the town of Barkly West. Since the days of Rhodes and Merriman the methods employed for extracting diamonds have advanced, with the result that the whole area has been re-excavated for diamonds. This being the case, it is quite impossible to regard the implements found here as found *in situ*. While it is noticeable that in every part of the diggings stratification appears to be clear and definite, yet this phenomenon is entirely due to the methods employed in seeking diamonds, sieving and washing, with the resultant artificial deposition of the gravels. It is therefore only misleading, and quite untrustworthy.

It can be seen, however, that the implements have originally come from the lowest gravels on the southern side of the river, and from the river-bed itself. There is no question at this point of higher gravels, as these only appear on the northern bank.

The artefacts found appeared to be all exactly similar in size, shape, and material to those found in other gravels, but are far too water-worn to allow of any conclusions as to method of manufacture being drawn. Both amygdaloid and *biseau* types were found.

G. Kuhn has sent in (M.M.K. 1258) a small well-made *coup-de-poing* 4 inches long and tending to be leaf-shaped; it is apparently of chert, and has taken the grey weathering so common in the Vaal gravels.

The specimens in the South African Museum (S.A.M. 688) appear to have been sent in from the Pniel Mission Station site, as they are more typical of this group than of the Old Pniel specimens. The weathering is more blue and the fractures easily visible. The specimens from Old Pniel, on the other hand, have weathered a very much lighter blue, touched here and there with yellow, and the fractures are all almost invisible. The weathering may be due entirely to the amount of chemical action, and the length of time it has been encountered.

The Pniel specimens in the Bloemfontein Museum are also all from the Mission Station site.*

Waldeck's Plant.

This site is further downstream and has been written up by Hodkinson. I was enabled, through the kindness of Miss Wilman, to visit this site with

* See van Hoepen, S.A.J.S., 1926, p. 793.

him, and to see the gravels in which the implements were found. Here, as in other diggings, the whole surface of the river bank has been pitted and dug into to a depth of some 30 feet by the diggers. The shafts lie closely together, and the whole of the gravels have thus been reached from the surface. Mr. W. H. Williams, a digger, has taken a great interest in the implements, and has submitted finds to various bodies, including the McGregor Museum and the Department of Physical Anthropology at the Witwatersrand University. These I have seen, including Mr. Williams' private collection.

Mr. Hodkinson in his paper * says of the implements he was inspecting,

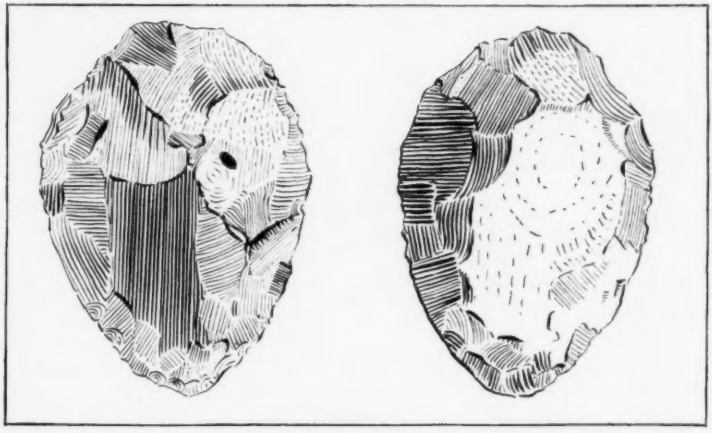


FIG. 7.—Two views of specimen M.M.K. 1475-2, Waldeck's Plant.

and which had been submitted by Mr. Williams: "Some of the implements were scattered upon the surface of the ground in the neighbourhood. These implements are quite distinct from the rest.† The other group of implements was found in diamond-bearing gravels at depths varying from 10 to 30 feet below the surface, the gravel being covered by a layer of red sand averaging 10 feet in depth. No implements were found in the superficial red sand. . . . Huge numbers of chips, and partly finished or rejected implements, were found in the gravel in a line about half a mile long."

Both rolled and unrolled implements were found.

The terrace in which the implements were found is not high above the present river-level, and cannot in any way be associated with the oldest (highest) Vaal terrace.

* E. T. Hodkinson, "The Stone Cultures of the Vaal River Diggings," S.A. Journ. Sci., 1926, p. 876.

† They are of the Smithfield industry, Later Stone Age.

Mr. Hodkinson differentiates five types of implements in the gravel finds: "Bouchers, cleavers, cores, flakes, and flayers." The bouchers, cleavers, and flakes are of the normal Vaal River types. (I have used the terms *coup-de-poing* and *biseaux*, for the two former.) The cores are of the type I have described above as "discoidal artefacts" or fabricators.

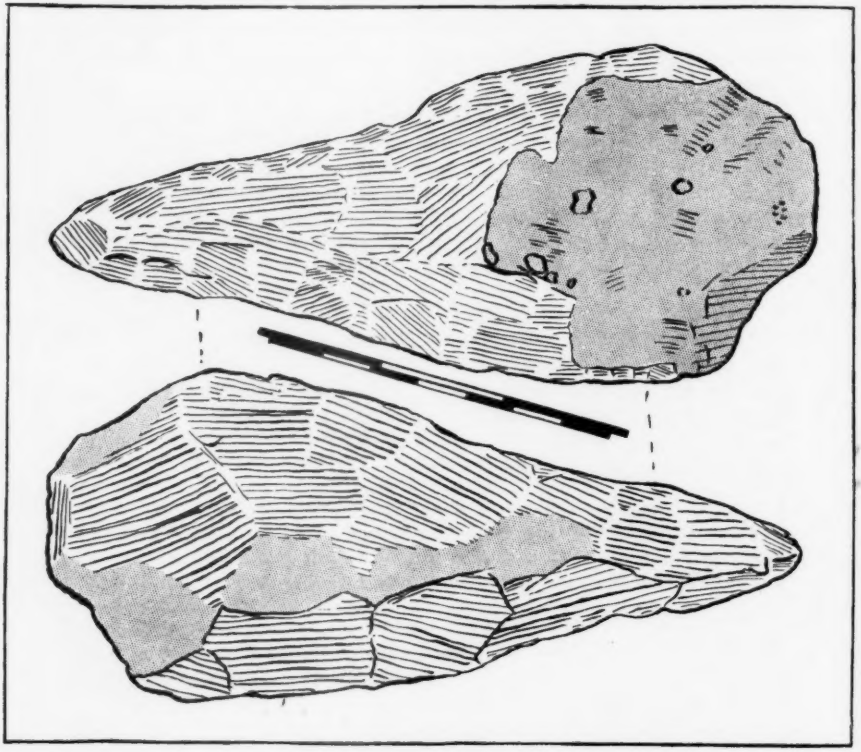


FIG. 8.—Two views of specimen M.M.K. 1475·3, Waldeck's Plant.

The flayers appear to be large flakes struck off but rejected as being too small in making the normal *coup-de-poing*. Flakes of a similar type appear from other sites on the Vaal River.

The "grinding" so noticeable on one specimen (a *biseau*) may be either the secondary ridge on the cleavage face of the flake or else due to the effect of the movement of the stone on one face. There seems to be very little point in using a grinding or polishing technique on a stone so very slightly worked and one so obviously in an early stage of manufacture.

The "ground" portion, too, appears to be far more like the sudden turn down of a flake after passing the secondary ridge of a conchoidal fracture.

The implements are of the type found at all other gravel sites on the Vaal River, and do not appear to differ to any noticeable degree. I have seen the group, and am judging from the actual specimens rather than from illustrations.

Mr. Williams has done further work since Mr. Hodkinson's visit, and wrote to Miss Wilman (8th January 1927) stating that he went down the shaft whence he got the *biseau* with the ground edge, and found numerous flake knives, scrapers, or perhaps just flakes from a factory. These all came from the same layer, at a depth of 15 feet, below sand.

At Kimberley (M.M.K. 1475) the implements Mr. Williams sent are of various materials: surface quartzite, diabase, shales, etc. There is a good variation in size (Plates XI and XVI), but the majority of the implements tend to an attenuated pear shape. One specimen is a perfect amygdal. There are a few specimens partially covered with a heavy concretion of river gravel material.

An interesting find (M.M.K. 1494) is from the surface at Waldeck's Plant, and consists of a single specimen of banded jasper of the wide almond shape so common in the neighbourhood of Griquatown (fig. 9). The nearest banded jasper is at least 60 miles west of Waldeck's Plant, and thus could not have become part of the river gravels. The similarity of weathering, material, and shape between this specimen and the south-westerly specimens points to the possibility of the river gravel material being considerably older than the Griquatown specimens.

With this specimen were sent in (M.M.K. 1495) two specimens from the river gravel. Neither is in any degree finished, and both show a cleavage surface over most of one face of the implement. They are of diabase.

Droogeveld.

J. P. Johnson * states that at Droogeveld, opposite the north-west beacon of the estate Droogeveld, where the estate touches the Vaal, "The upper terrace is mainly made up of tufaceous limestone with a sprinkling of fine river gravels. From this terrace were obtained numerous much water-worn implements made of greenish-black aphanite, which has weathered a reddish brown on the outside. They would appear to be much older than the gravel in which they appear." It is a little difficult to make out what types of implement he speaks of; they would appear to be flakes,

* Johnson and Young, "The Relation of the Ancient Deposits of the Vaal River to the Palaeolithic Period of South Africa," Trans. Geol. Soc. S.A., 1906, vol. ix, p. 59.

scrapers, etc. The only implements I have seen from this site are one specimen from H. Skill (M.M.K. 1589) and the implement illustrated (Plate XVI, M.M.K. 1114); the former is of a type exactly similar to those sent in from Windsorton by Wohlfahrt (M.M.K. 1183) and to those submitted to the South African Museum by Helme (see above). These

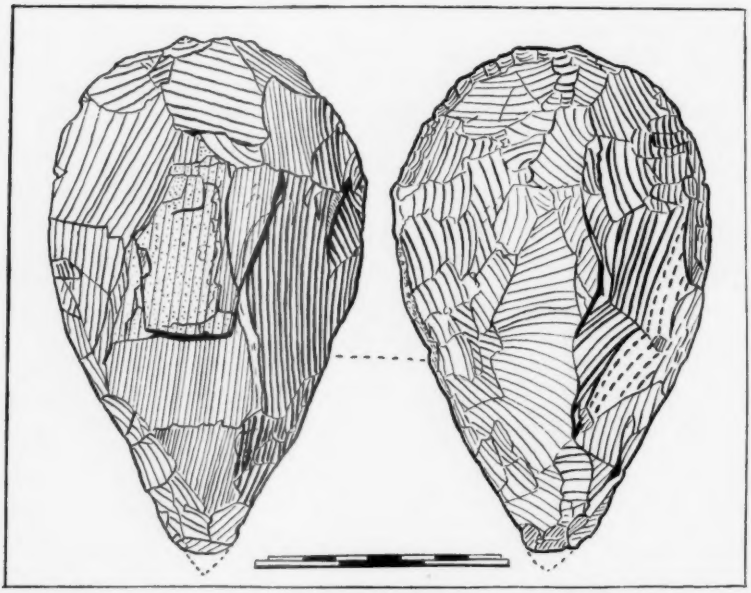


FIG. 9.—Jasper implement from surface, Waldeck's Plant, M.M.K. 1494.

artefacts are, however, quite as unassociable as the others. Mr. J. H. Power of Kimberley has discovered (M.M.K. 1583) similar artefacts at Kimberley.

ROOIPOORT.

This estate adjoins Droogeveld, but does not touch the Vaal River. The implements from here are of interest, owing to their similarity to the gravel types of the Vaal. Mr. J. H. Power submitted a number of specimens from here (M.M.K. 1590). The implements in his first group are made of an amygdaloidal diabase and tend to be small (4½ inches or 11 cm.). The artefacts show part of a lateral cleavage plane on one face. The implements are leaf- and almond-shaped.

A later find on the same farm (M.M.K. 1594) shows a similar technique, but the implements are a little larger. One specimen showing the cleavage

surface over the greater part of one face is of the *biseau* type, 7½ inches long. The more finished specimens from this site measure about 5 inches, and are ovate and amygdaloid in shape.

Middelplaats North.

Two implements have been sent to the Kimberley Museum from here (M.M.K. 1086). These are both of a quartzitic sandstone. One is leaf-shaped, the other shows a worked outer face, while the cleavage face is only slightly worked. From the rough chipping round the edge it would appear that an unsuccessful attempt had been made to work that face also.

Method of Manufacture.

In any paper dealing with the manufacture of stone implements, it must be remembered that when a flake is struck off a stone it is struck from the upper face (nearest the striker), but is removed from the under face. It is therefore obvious that when one face of an implement is being worked, all the workmanship is invisible, unless the maker goes to the trouble of turning the stone over after striking each blow. This fact would probably be unnecessary to point out except that the misleading term " alternate flaking " has sometimes been applied to the effect obtained by knocking flakes off the whole of one face, turning the stone, and doing the same thing on the opposite face. This gives a wavy edge to the implement if it is looked at from the edge.

Using this method, and striking flakes off the implement at a rate of a flake in two seconds, it will be seen that a *coup-de-poing* takes under five minutes to make. While my normal speed for making a *coup-de-poing* is well below this, I am allowing a minute or two extra. It is these facts and these alone that account for the great profusion of artefacts discoverable on one workshop site. The maker had to work on a surface which was out of his view entirely, then turn the stone over. If the work was not to his liking, the artefact was thrown aside. If the work was sufficiently good, the artefact would be turned over and the same attempt would be made on the other face. Again, he was working on an invisible face, and cause for rejection might appear here also.

The chief defect in a stone implement, and one for which some thousands of rejects were thrown out, is the fact that if a flake fails to " run up," but breaks off short (step flake), it may leave an awkward lump about an inch or so from the edge. This lump cannot be removed by any normal method. A chisel is necessary, but was apparently not forthcoming among makers

of the *coup-de-poing* types.* Such a lump would detract from the usefulness of the implement, and hence a large number of rejects show this lump somewhere on (presumably) the face worked the later by the maker.

One other point has interested me for some years. This refers to the *biseau* type of implement. Of the thousands I have seen, none show the same degree of finish visible in the *coups-de-poing*. This has led me to the belief that these are not implements but rejects, of a special type, and rejected at a particular phase of manufacture. A digression into still earlier stages in the manufacture of the *coup-de-poing* will explain this.

The commonest method used in South Africa in making the *coup-de-poing* is to take a boulder, strike off a flake, discard it and strike off a flake below the former one, obtaining thus a flat, oval stone some 10 inches long, 8 inches across, and 1½ inches deep. The implement would then be made from this, and would probably be 5 inches long, 3 inches wide, and an inch thick. Now it is immediately obvious that, in striking off a flake of this size, the accuracy possible would not preclude that the needed flake would be wedge-shaped rather than a perfect flat disc. Such a flake might be useful, and was evidently used in a number of cases, the point of the *coup-de-poing* lying along the flake in the direction of the wedge. Thus the point, the thinnest part of the *coup-de-poing*, would be made from the thin end of the wedge. In the other case it would appear to me that the maker, after doing the preliminary work from both faces, being careful not to touch the thin end of the wedge until the final stages, discovered that the thinness of the " chisel edge " so left would not allow of a reasonably strong and shapely point being made. Hence the partly finished *coup-de-poing* would be rejected, leaving an axe-like edge, which we, from analogy with the modern axe, have presumed to be according to plan.

One point of interest here : from Pniel and other sites come peculiar triangular *biseaux*.† These are made the reverse way of the wedge, the butt end towards the thin end of the wedge and the point worked down from the thicker end. Two are illustrated (text-figs. 4 and 5) in this paper, and it will be seen that no specimens of any " finish " appear. The *biseau* is seldom well made, and often is no better in workmanship than Péringuey (pl. viii, fig. 57).

However, in spite of holding this view, I have mentioned the various sites whence this artefact (the *biseau*) has appeared. Most investigators are against this view, and the feelings of the majority must be con-

* Stone masons and other investigators state that the removal of such a lump is impossible without either breaking the edge of the stone and removing a great part of the face, or breaking the stone at right angles (*i.e.* across the breadth of the stone) to the line of striking.

† See Péringuey (pl. viii, fig. 53).

sidered. This point will be mentioned later in treating of the Fauresmith industry.

The methods employed all along the Vaal River by the makers of the *coup-de-poing* are identical. First a flake was struck from a boulder, followed by the removal of another flake immediately below the cleavage face of the former. This was taken, and the edge having the positive bulb of percussion would first be worked away (Plate VII). The flake would be turned directly over, and the diagonally opposite face worked away similarly. The effect of this is to produce a flat stone, the cross section of which approaches a parallelogram. If the flakes ran far enough into the face of the stone, the process was continued on the hitherto unworked edges. If not, the stone was rejected. Such, briefly, is the method employed along the Vaal River. This method is also to be seen in specimens from Mossel Bay, Knysna, Stellenbosch (only a few instances), and other sites. In all instances the formula remains the same, the flake being a lateral flake, the implement being made across the direction of the original blow.

This is of extreme interest, as it helps us in our realisation of the main difference between the culture here represented (the Stellenbosch) and that so common in the Free State (the Fauresmith). In the former we are dealing with a *coup-de-poing* made normally from a lateral flake, the *biseau*, and a "discoidal artefact" or round fabricator. In the Fauresmith industry we find a *coup-de-poing* made normally from a longitudinal flake (struck off where the butt of the *coup-de-poing* will be), the *biseau* is absent entirely, and in its stead we get a considerable number of small flake tools, usually about 2 or 3 inches long, and worked along one or both edges. The discoidal artefact is still present.

To my mind it would appear that the knowledge of the longitudinal method of flaking marked a very definite advance in technique, making it possible to eliminate the *biseau* type of reject altogether, and to evolve a fluted flake implement, made from a flake definitely struck from a core for that particular purpose. On the other hand, it is worthy of note that many of the implements from the Vaal River sites approximate much more closely to the finished Fauresmith specimens than they do to the finished Stellenbosch examples.

Conclusions.

We are thus in the presence of an industry similar to that appearing at Stellenbosch and other sites, and therefore most probably to be associated with these in a single culture.

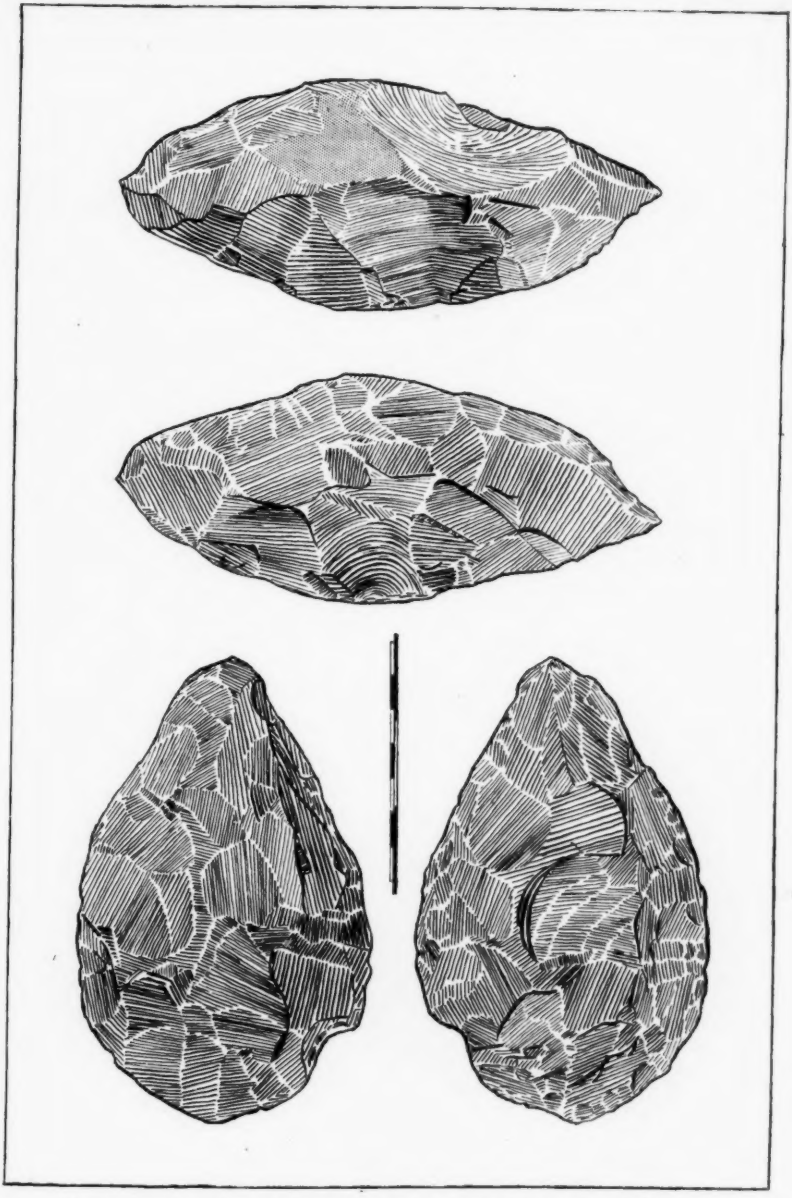
It is possible to date the industry as later than the beginning of the Pleistocene period, and of considerable age. This fact is vouched for by the discovery of the fossils in the highest terraces at Waldeck's Plant, and

by the fact that the implements are in every case only to be found in the later (lower) terraces. The fact that they are found in more than one terrace points to a long period during which the culture held sway on the Vaal. It is possible that the Griquatown types of banded jasper are later than the Vaal types, as no implements of this type and material have been found in the gravels, but a single specimen occurs from above the gravels (fig. 9).

With the discovery of further fossils it should be possible to date these finds very much more accurately, and for this reason it is to be hoped that in future some method will be found whereby fossils found by diggers will be taken proper care of, and the position of each collated with our knowledge of the prehistoric period.

I desire to thank Miss M. Wilman, the director of the McGregor Museum, for the help she has given me in providing the opportunities of seeing the various sites, and also for allowing me full use of the Museum collections. Without her aid this work would have proved impossible.

I have pleasure in thanking my wife for assisting with the drawing of the specimens, and Mr. Duggan Cronin for his excellent photographs.



Two views of specimens M.M.K. 1416·1 (above) and 1416·2 (below), Windsorton.

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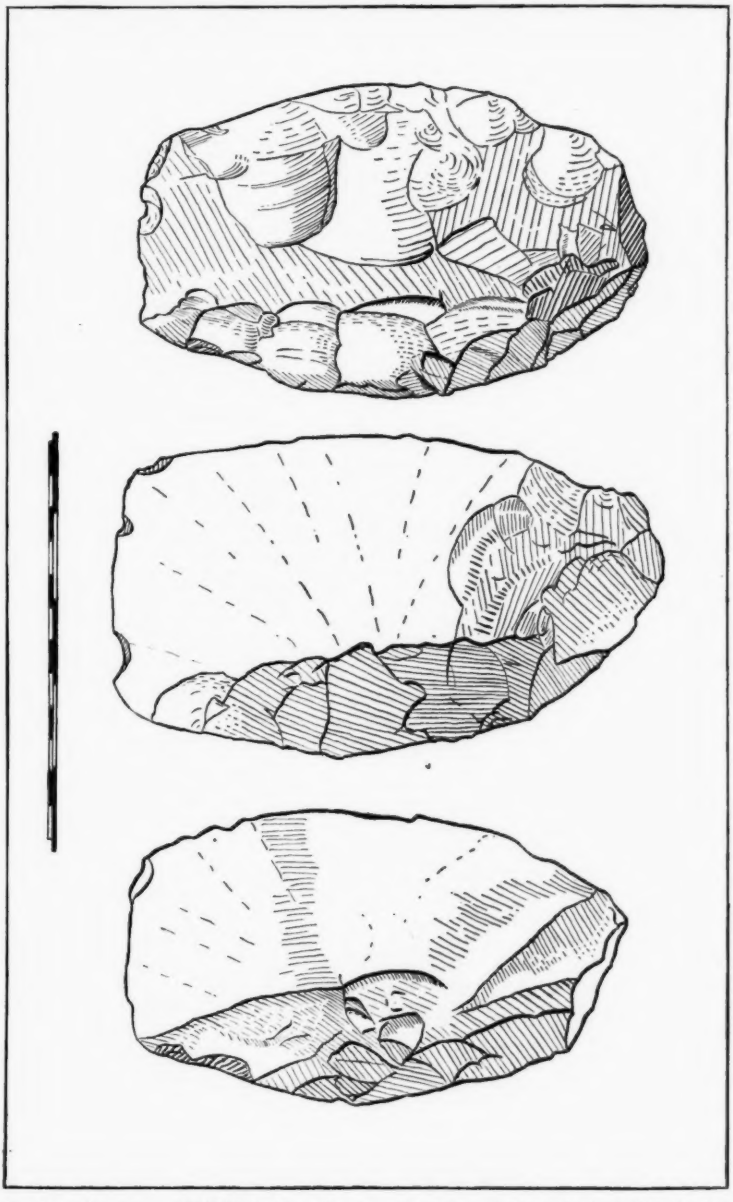

One face of specimens M.M.K. 1417·1 (above) and 1417·2 and 1417·3 (below), Windsorton.

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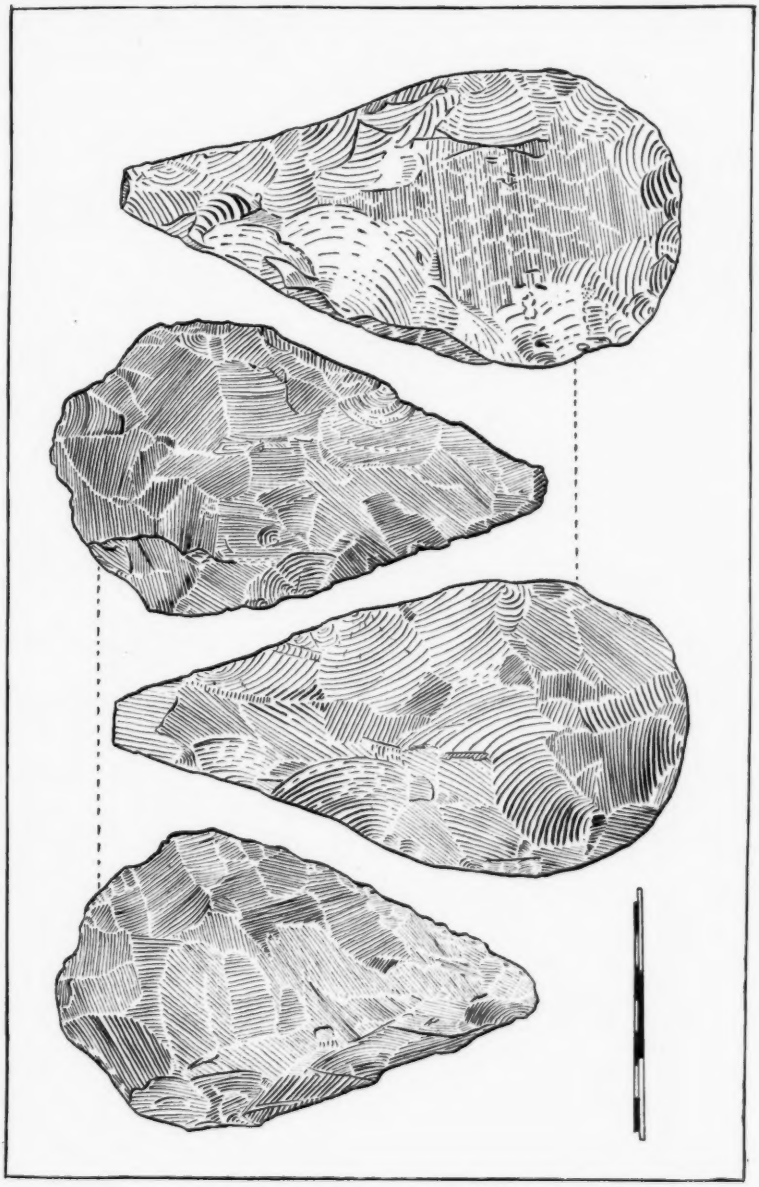

Two views of specimens M.M.K. 1417·4 (above) and 1417·5 (below), Windsorton.

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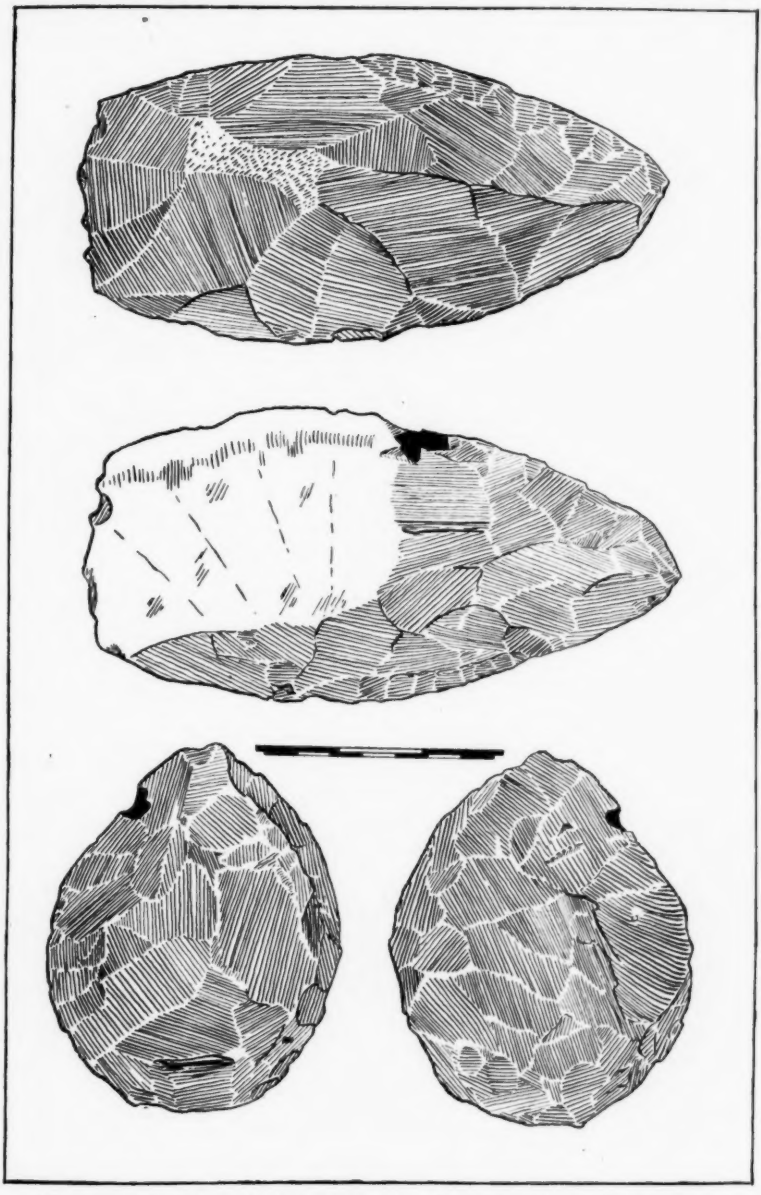

Two views of specimens M.M.K. 1430·1 (above) and 1472·1 (below), Windsorton.

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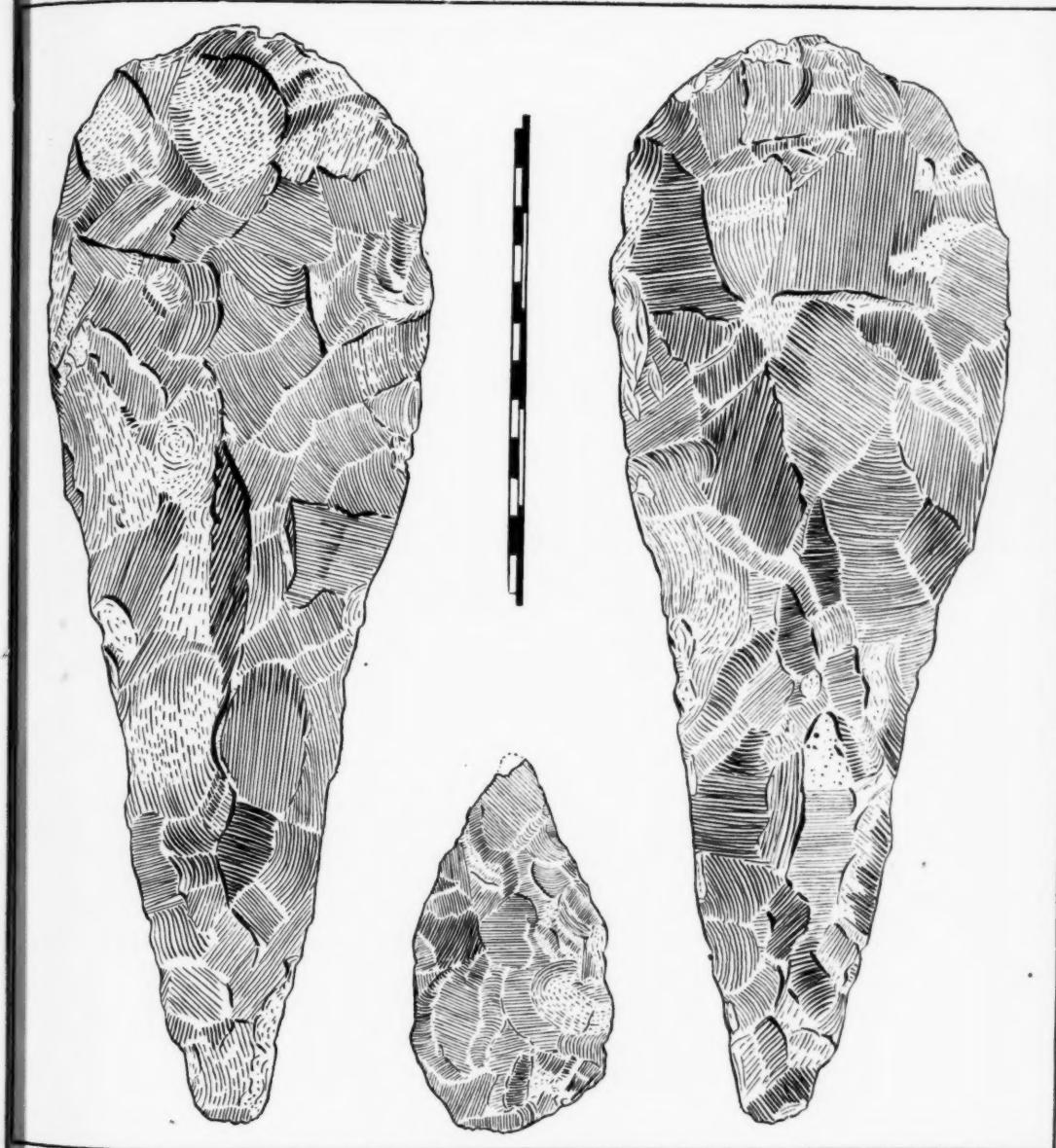

Two views of M.M.K. 1617, and one face of 1598 (centre), Pniel.

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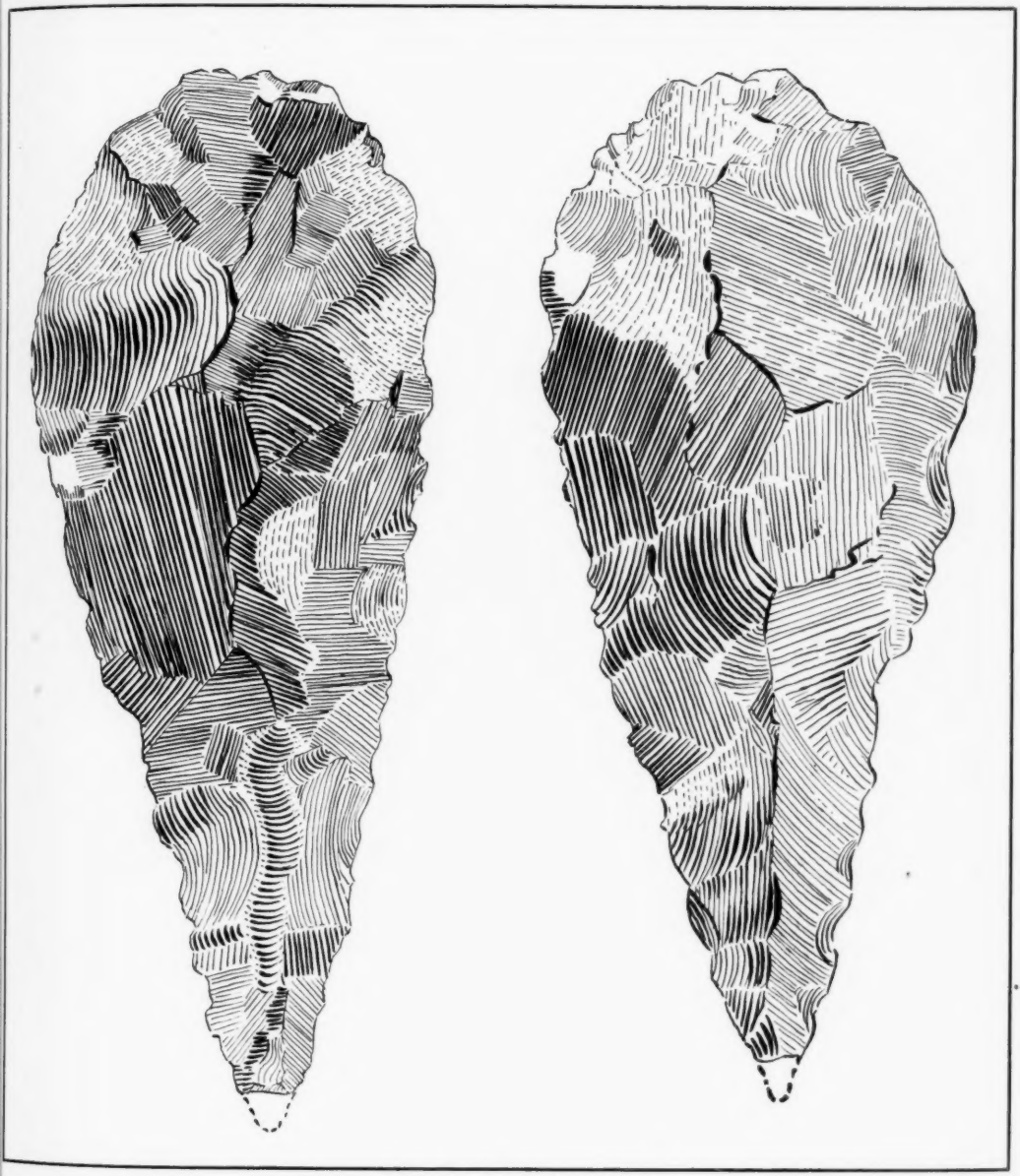

Two views of M.M.K. 1475-1, Waldeck's Plant.

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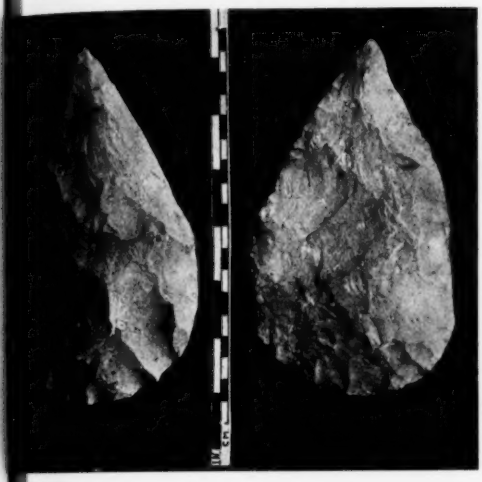

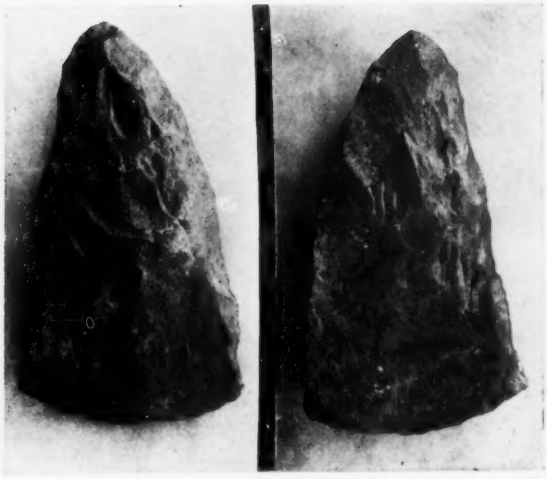

Views of large specimen from Windsorton (M.M.K. 1415), also of *biseau* (1417) top right, and normal *coup-de-poing* (1415) top left.

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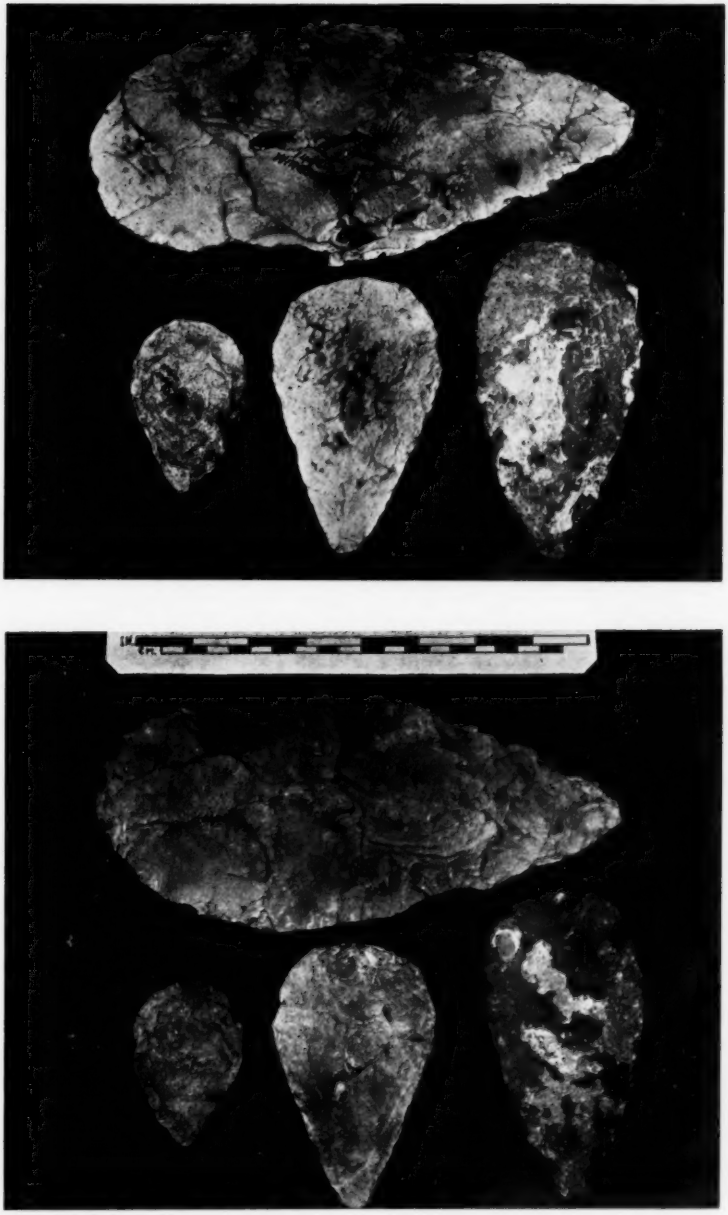

Two views of well-made specimens from Windsorton (M.M.K. 1416 and 1496).

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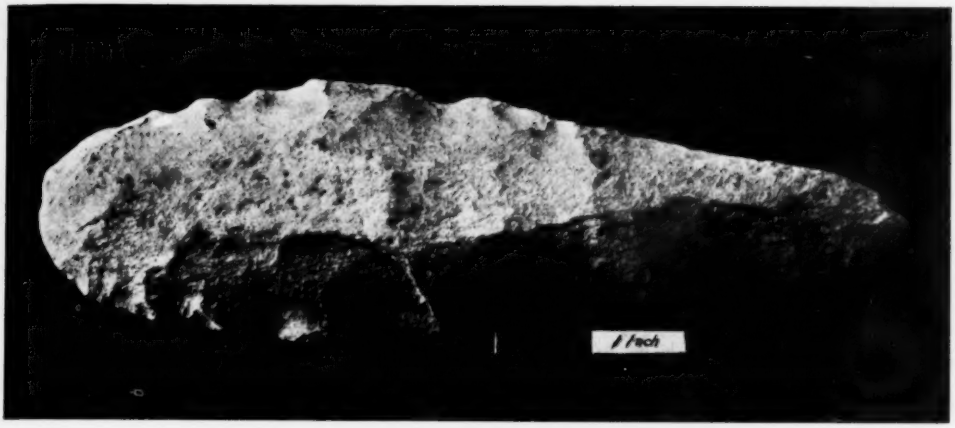

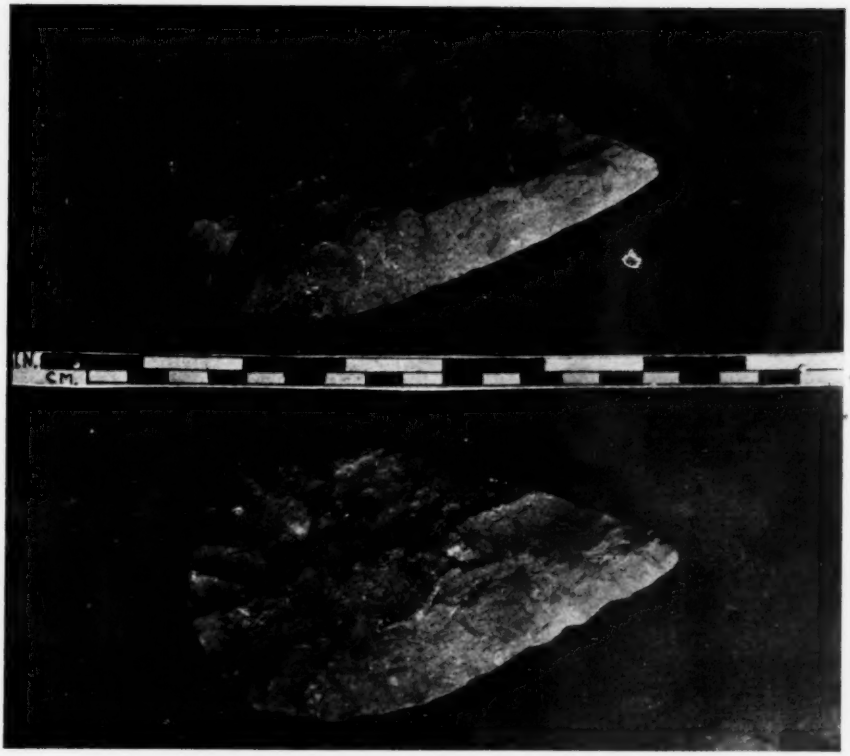

View of Windsorton (M.M.K. 1622), and two views of Windsorton (1421).

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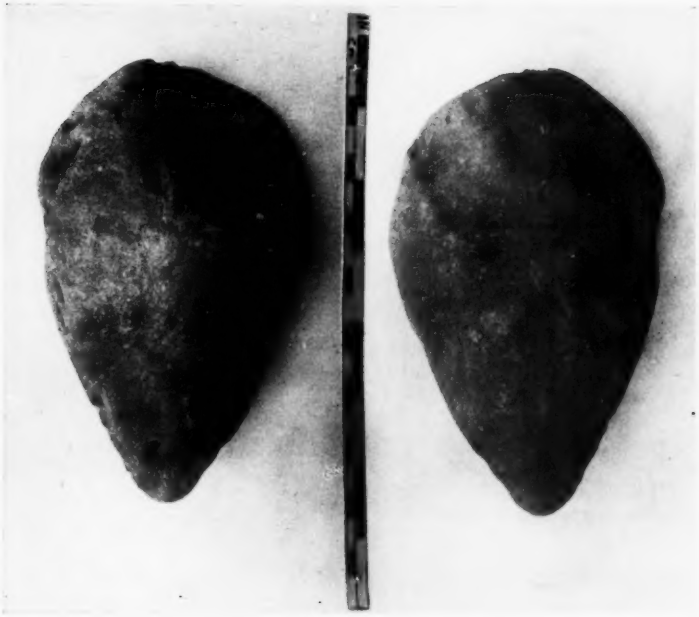

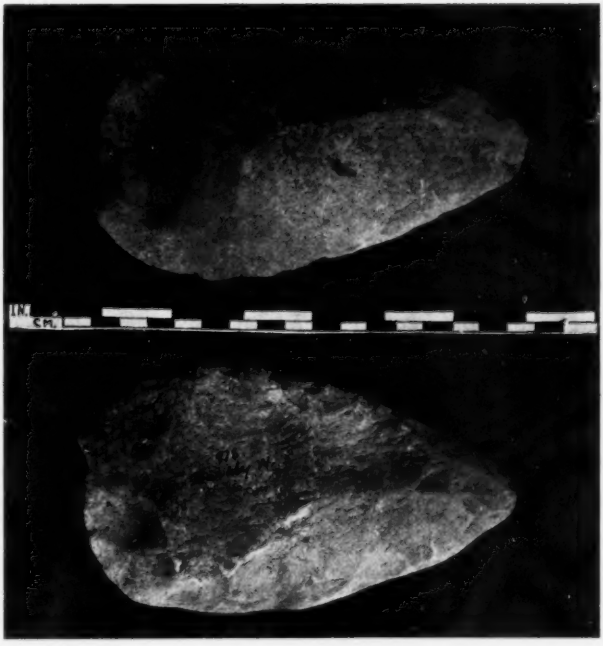

Two views of specimens from Canteen Kop (M.M.K. 728), to show excessive rolling, and Barkly West (978).

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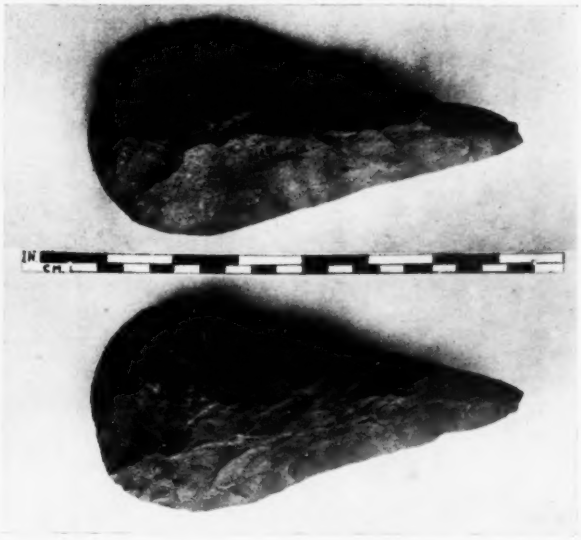

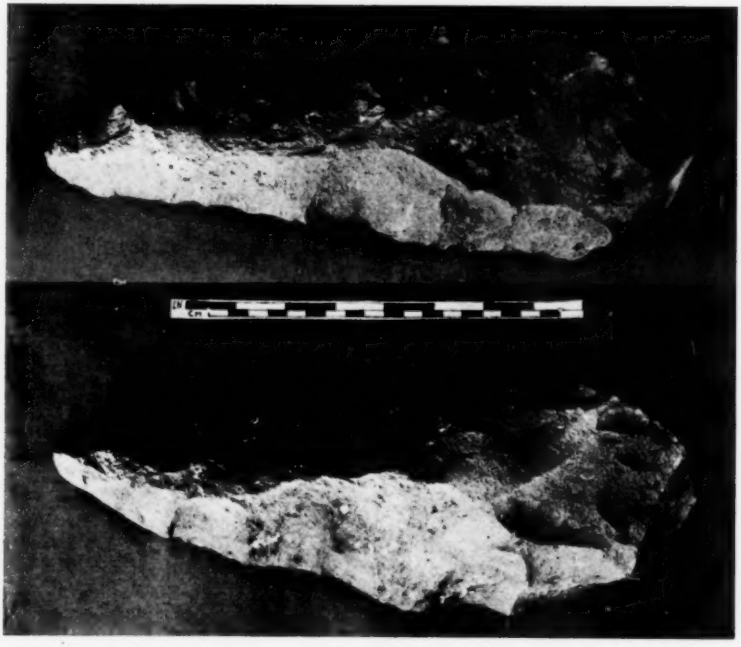

Two views of specimens from Droogeveld (M.M.K. 1114), and Waldeck's Plant (1475) below.

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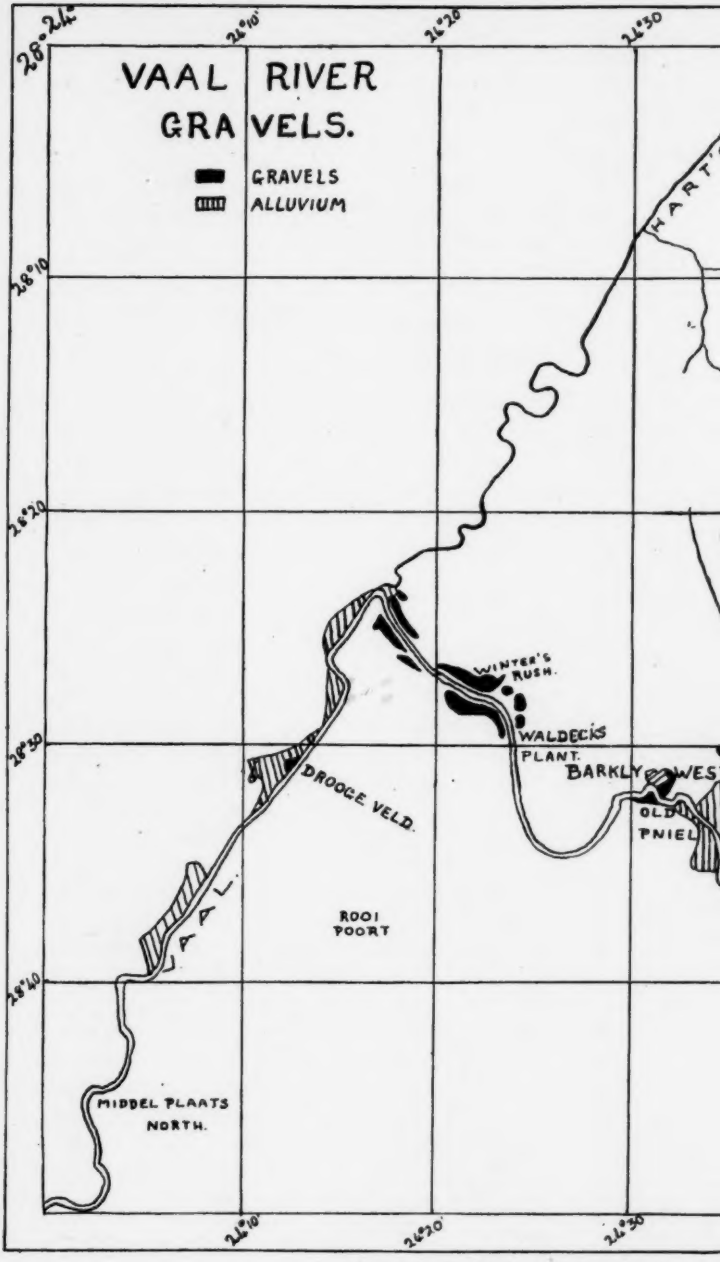
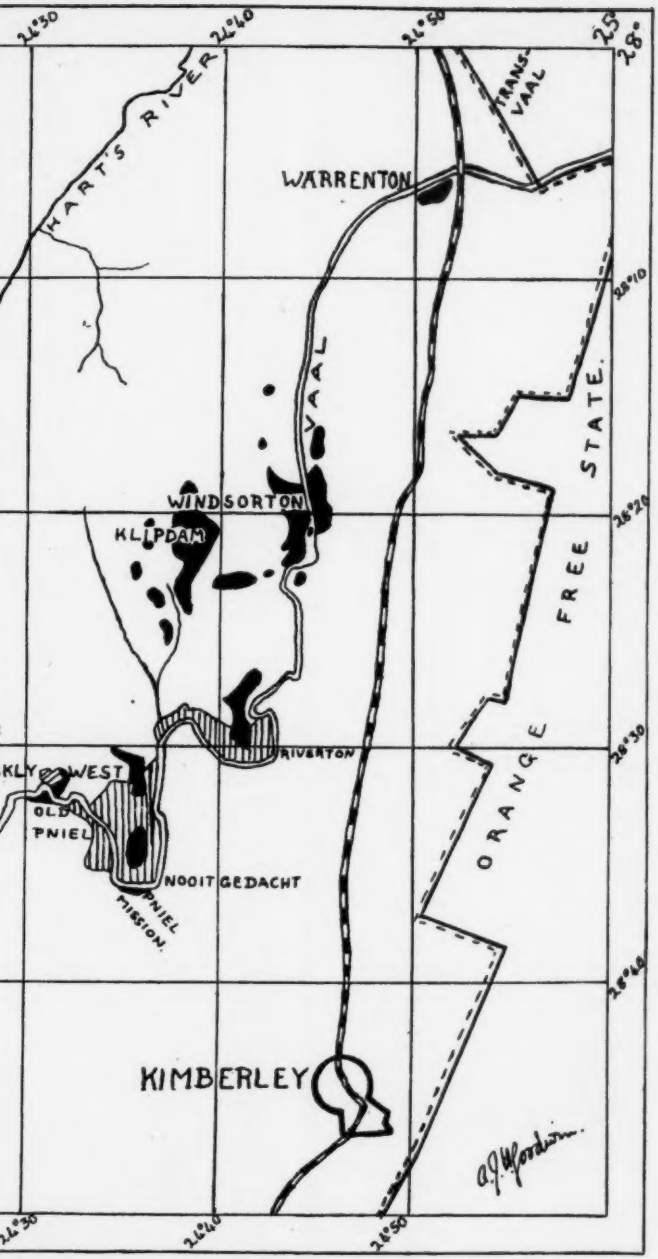


Map of the Vaal River and Gravels, after Geo



vels, after Geological Survey (*du Toit*).

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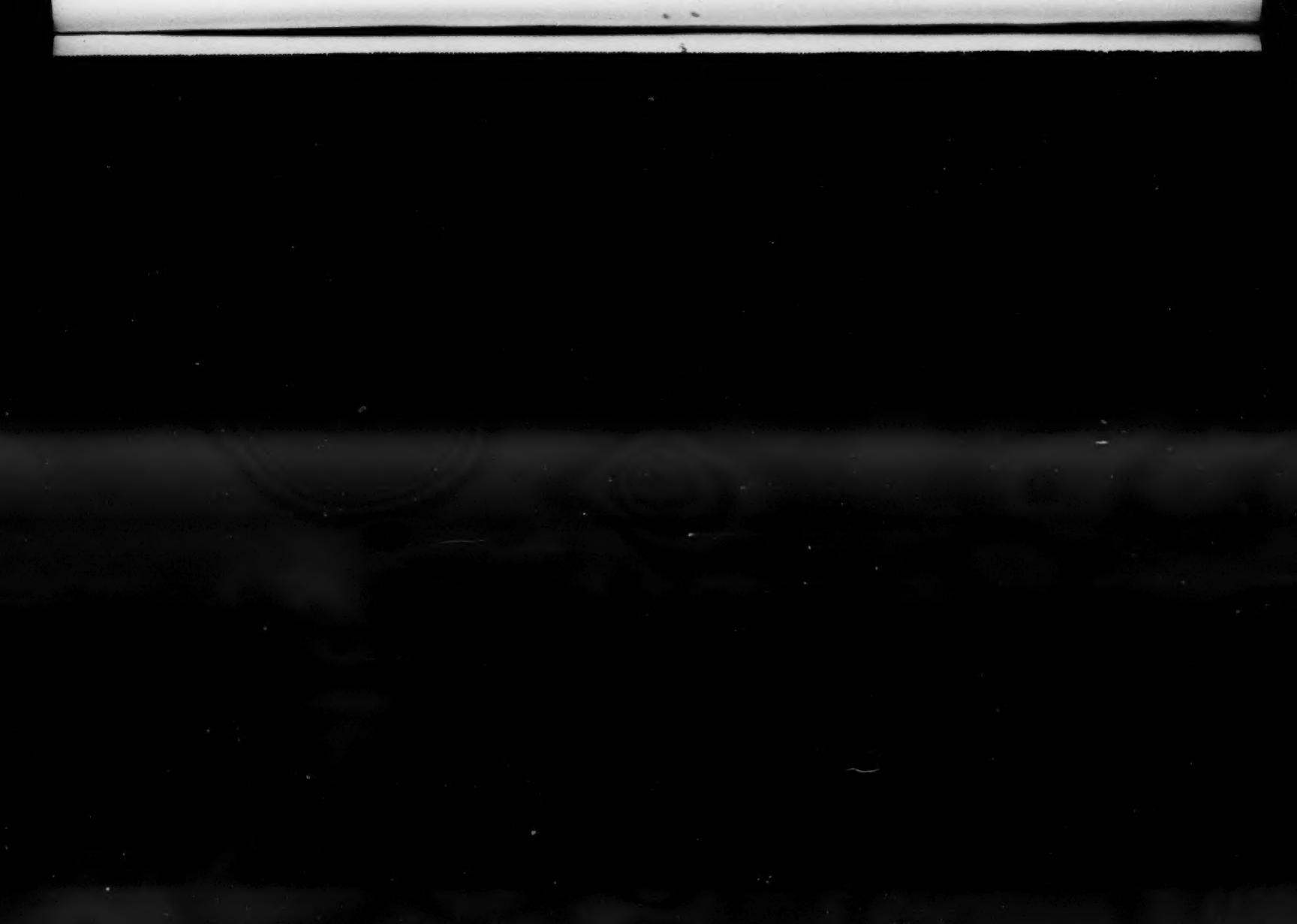

STUDIES IN THE GROWTH OF GRAPES.

Part IV.—Initial Changes in Acidity.

By P. R. v. d. R. Copeman, B.A., B.Sc.

(With one Text-figure.)

In the previous papers * of this series it has been pointed out that in the initial stages of growth of the berry the acid shows an increase until a maximum value is reached. After this stage has been reached the berry ripens rapidly and the acidity decreases until a practically constant minimum value is reached at maturity. During the period of decrease the changes in acidity have been shown to be well represented by the equation

$$\log \frac{a}{y-a} = k(t-t_1).$$

On previous occasions it has not been possible to attempt an analysis of the curves obtained during the period of increasing acidity. In the case of the results for 1923 and 1925 the work was commenced too late in the season for any increase of acid to be apparent, while in 1926, although this stage was evident, the period of increasing acid was too short to be of any assistance in deducing the course of the changes. Lewis † states that the acidity increases to a maximum, and the point of maximum acidity agrees closely with the increase in sugar and the appearance of laevulose, *i.e.* with the beginning of the ripening period.

During the 1927 season grapes from Paarl were analysed for the purpose of comparison with grapes from Constantia, and the work was commenced as early as possible in order to obtain some clear idea of the initial changes which occur in the development of the berry. The present paper deals with the results obtained during the period of increase of acidity. The early commencement of the work enabled a series of readings to be obtained during this stage which extended over a period of six to eight weeks, and sufficient data have been accumulated to enable an idea to be formed of the nature of these changes. The data obtained during this period are given in Table I, in which the acidity was expressed as grammes of tartaric acid per 100 c.c. of juice.

* Copeman, Trans. Roy. Soc. S. Afr., 1926; 1927.

† Lewis, Dept. of Agric. Bull. No. 69, 1910.

TABLE I.

Date.	White Hanepoot.	Barbarossa.	Flaming Tokai.
1/12/26	2·68	2·22	2·22
7/12/26	2·97	2·30	2·50
14/12/26	2·96	2·40	2·70
21/12/26	3·20	2·62	3·06
28/12/26	3·38	2·80	3·13
4/ 1/27	3·46	2·94	3·25
11/ 1/27	..	2·87	3·32
18/ 1/27	..	2·94	..

When the work was commenced the berries were very green and hard and presumably had not been formed for any length of time. They were as nearly as possible in the form in which they first appeared on the bunch. The total period from the time when the berries first appear until the grapes are fully ripe is roughly about three and a half months, and in accordance with this period it would appear that about two weeks must have elapsed before the present observations were commenced. At no stage of this initial period was there any clear indication that growth commenced with zero acidity, and it seems unlikely that there could be such a sudden rise to over 2 per cent. of acid in a matter of a couple of weeks. On examining the curves the existence of a reverse curve of growth was plainly evident, and it became clear that the best method of expressing the curve was by means of the autocatalytic equation as developed in previous papers. Since the evidence of initial zero acidity was plainly lacking, it would appear that the particular cycle of growth under consideration only commenced when a definite concentration of acidity was already present in the juice of the berry.

Under these circumstances the type of autocatalytic equation to be adopted must be of the form

$$\log \frac{y-c}{d-y} = \mathrm{K}(t-t_1),$$

where "c" is the concentration of acid prior to the onset of the growth cycle represented by this equation; "d" is the final concentration of acid at the completion of this growth cycle, so that the total change of acidity is represented by "$d-c$"; $\mathrm{K}=k(d-c)$, where "k" is the velocity constant of the change during this cycle; and t_1=time when the acidity "y" is equal to $\frac{d+c}{2}$, *i.e.* the "half period" of the change.

The constants were calculated in the same way as in previous papers and are given in Table II for the three varieties of Paarl grapes which were used.

TABLE II.

Variety.	*c*.	*d*.	K.	t_1.	*k*.	$\frac{d-c}{K} \times 10^{-2}$.
White Hanepoot .	2·50	3·55	0·0510	15·0	0·0486	20·6
Barbarossa . .	2·10	3·02	0·0529	20·0	0·0576	17·4
Flaming Tokai .	2·10	3·40	0·0514	15·0	0·0395	25·3

The agreement between the observed and calculated values for the acidity is shown in fig. 1. It is evident that in this early stage of growth

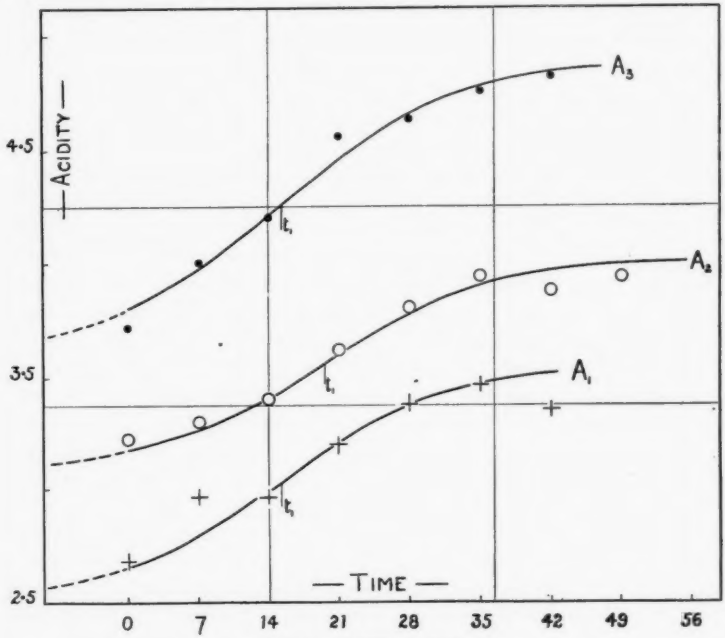

FIG. 1.—Acidity of Juice.

+ White Hanepoot.
○ Barbarossa. Curve = Acid + 1·0.
● Flaming Tokai. Curve = Acid + 1·5.

The curve gives the changes in acidity during the initial period of growth. The points A_1 . . . A_3 mark the respective stages where the curve of decreasing acid meets the above curves.

there is great similarity in the changes for all the varieties. It will be seen that the White Hanepoot is distinguished by the higher value of the initial and final concentrations of acid. The actual amount of acid produced

during this cycle depends upon the variety of grape, *e.g.* 1·05, 0·92, 1·30 per cent. for the order given in the table. Although the values of "K" are very similar for the three varieties, it can be seen that the values of the growth-velocity constant "*k*" vary according to the variety. It is clear from the comparatively high values for this constant that this cycle of growth is a relatively rapid one. The differences in the varieties is brought out by comparison of the growth-capacity constant, from which it is seen that Flaming Tokai has the greatest capacity for production of acid during this cycle.

Prior to the onset of this growth cycle the concentration of acid in the juice must be at least that given by the value "*c*" in Table II. During the complete development of the grape, therefore, three stages must occur in the changes in the acidity. The first stage ends with the production of "*c*" grammes of acid per 100 c.c. of juice; the second stage consists of the increase in acidity to its maximum value "*d*"; and the final stage is completed by the decrease of acidity to the minimum value obtained at maturity. The results obtained in this paper indicate that the acidity has a value of "*c*" at a period of about two or three weeks prior to the commencement of observation. This period is practically coincident with the time at which the berries *first* begin to appear on the bunches. It can only be concluded that the actual berry is formed only when a concentration of "*c*" grammes of acid is already present, and this conclusion leads to the assumption that this must be the concentration of acid which must be present in the sap of the pedicles on the bunch or in the liquid which must be stored at the base of the flower from whence it is transferred to the berry when the latter just commences to be formed. This assumption is supported by the conclusions which may be drawn from the initial changes in the soluble solids and total solids of the berry. In a previous paper it has been shown that the changes, which occur during the ripening period in the soluble solids, only take place after an initial concentration of about 4 to 5 grms. has been attained. There is some evidence that this value is attained after a slight decrease in concentration has occurred. In the case of the total solids the evidence is perfectly clear that the initial cycle of growth in the berry is accompanied by a decrease in the total solids. This can only occur on the assumption that the formation of the berry is initially dependent upon an influx of water, and it may be concluded that this influx is due to some forward movement of liquid into the base of the berry. This would bring about the required concentration of acid provided that the acid is present at approximately this concentration in the liquid, which passes into the berry in the initial process of formation.

Division of Chemistry,
Cape Town.

STUDIES IN THE GROWTH OF GRAPES.

Part V.—Relationship between Sugar and Soluble Solids in the Juice.

By P. R. v. d. R. Copeman, B.A., B.Sc.

(With one Text-figure.)

During the process of ripening in grapes the changes taking place in the sugar content of the juice follow closely the changes in the soluble solids, and it has been pointed out in previous papers of this series * that the changes in the latter quantity are almost entirely due to the changes in the sugar content of the juice. It has been shown that the rate of production of soluble solids is practically equal to the arithmetical sum of the rates at which the changes in the sugar and acid content of the juice take place. During the later stages of the ripening process in a fruit, such as the grape, the amount of acid becomes practically negligible in comparison with the amount of sugar, so that the rates of production of sugar and soluble solids become practically identical. Under such conditions it may be expected that the relationship between these two factors would be very close and, in fact, tend to be linear.

In a paper on "The Changes in the Chemical Composition of Grapes during Ripening," Bioletti, Cruess, and Davi † draw attention to the fact that the differences between the soluble solids and the sugar content of the juice become less as the grapes ripen, but no general conclusions have been drawn in regard to this fact. It has been found ‡ that the Balling (or Brix) degrees of the juice agrees with the amount of soluble solids per *100 grams* of juice within the limits of experimental error. It was pointed out that, at maturity, there is a general difference of 0·8–1·2 between the Balling degrees of the juice and the sugar content per *100 c.c.* In this way it is, therefore, possible to obtain by subtraction an approximation to the sugar content of the juice. Caldwell § has drawn attention to the difficulties

* Copeman, Trans. Roy. Soc. S. Afr., vol. xiv (1927), p. 267.

† Bioletti, Cruess, and Davi, Univ. of Calif. Pub. in Agric. Sc., vol. iii (1918), p. 103.

‡ Copeman, Bull. Dept. Agric., Div. of Chem. Ser., No. 75, 1927.

§ Caldwell, Journ. Agric. Res., vol. xxx (1925), p. 1133.

of using determinations, based upon specific gravity measurements, to calculate the sugar content of fruit juices. It is pointed out that accurate analyses of each type of fruit juice is necessary before a spindle can be used with any degree of accuracy. The present paper deals with the possibility of estimating the sugar content of grape juices by means of a Balling hydrometer.

In previous papers of this series * the equation used to represent the changes which occur in the sugar content of the juice during the process of ripening was

$$\log \frac{y}{a-y} = K(t-t_1) \quad . \quad . \quad . \quad . \quad (1)$$

where y = amount of sugar at time t and a=amount of sugar at maturity. K_1=constant and t_1 is the time when the amount of sugar is $\frac{a}{2}$.

The changes in the soluble solid content of the juice were expressed by means of the equation

$$\log \frac{x-c}{b-x} = K_2(t-t_2) \quad . \quad . \quad . \quad . \quad (2)$$

where x = amount of soluble solids at time t and c=amount of soluble solids which are present prior to the commencement of the growth cycle represented by this equation. K_2=constant and t_2 is the time when the soluble solids in the juice reach a value $\frac{b+c}{2}$, *i.e.* $\frac{b-c}{2}+c$.

Eliminating t from equations (1) and (2) the following expression is obtained to express the sugar in terms of the soluble solids

$$K_2 \log \frac{y}{a-y} - K_1 \log \frac{x-c}{b-x} = K_1 K_2 (t_1-t_2) \quad . \quad . \quad (3)$$

In practice it has been found that K_1 was very nearly equal to K_2, the very small difference being due to the relatively small amount of acid present in the juice of the ripe fruit.

The periods at which half the final amount of sugar and soluble solids are formed, *i.e.* the "half-periods," are practically coincident, so that t_1 is practically equal to t_2.

As a first approximation these quantities may be taken as equal, so that equation (3) reduces to the form

$$\frac{y}{a-y} = \frac{x-c}{b-x}.$$

* Copeman, *loc. cit.*

On simplification the following equation is obtained to express the sugar in terms of the soluble solids :

$$y=\frac{a}{b-c}(x-c),$$

i.e. $$y=m(x-c) \quad . \quad . \quad . \quad . \quad . \quad (4)$$

It has been shown that the values of a, b, and c vary for each variety of grape, and therefore the constants of the above equation may be expected to vary in the same way. Since, however, the constants for any given variety grown in one locality vary only very slightly with seasonal conditions the expression obtained for any one variety will be, in the case of this variety, of general application for any season. This has been found to be the case, the variations for any given variety being well within the limits of experimental error.

In Table I the average constants for six varieties of grapes are given. The varieties were obtained from Constantia, and the results for three seasons are averaged. The values of m and c have been determined from the values of a, b, and c for each variety. In this case both sugar and soluble solids have been expressed in terms of grams per 100 c.c. of juice.

TABLE I.

Variety.	m.	c.
Hanepoot . . .	1·08	3·86
Gros Maroc . . .	1·11	4·12
Barbarossa . . .	1·08	3·50
Waltham Cross . .	1·13	3·63
Flaming Tokai . .	1·04	4·05

It has already been pointed out that for all practical purposes White and Red Hanepoots may be regarded as identical so far as their characteristic properties are concerned. On this account the constants for " Hanepoot " include the values for both the Red and White varieties.

The very close agreement between the observed and calculated readings is shown in fig. 1, in which the values for both varieties of Hanepoot are employed. From this curve it may be concluded that the assumptions, upon which the results are based, are justified and therefore the equation, as developed, must express closely the true conditions. It is clear that in the case of grapes the changes in the soluble solids are directly dependent upon the changes in the sugar content of the juice.

If the various factors had been expressed in grams per 100 c.c. the same form of expression would still be applicable. In this case, however, the constant c would have a slightly different value, although the value of m would remain unchanged. If, on the other hand, x_1 be the amount of soluble

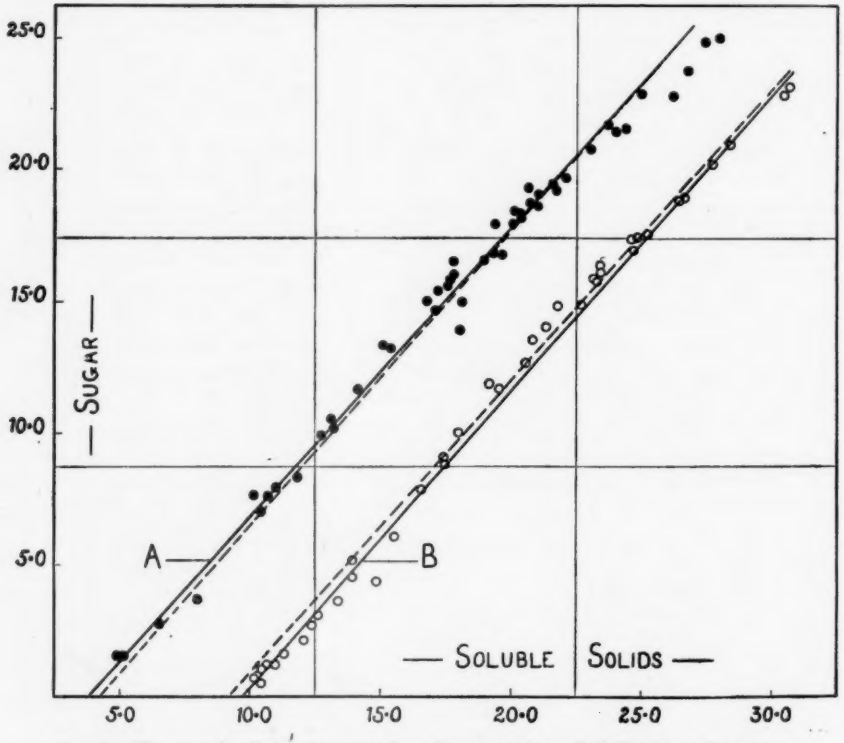

FIG. 1.—The curve for Hanepoot grapes from Constantia is marked A and that for grapes from Paarl is marked B. Curve B has been moved to the right by the addition of 5·0 to the readings for the "soluble solids."

solids per *100 grams* of juice, then the amount of sugar per *100 c.c.* will be obtained by means of the expression

$$y = m\,(x_1 d - c),$$

where d is the density of the juice.

In practice it has been found that x_1 is equivalent to the Balling degrees of the juice. It is, of course, necessary to work at a standard temperature, but the correction for temperature may be readily applied to the Balling

reading by means of tables. To obtain accurate readings it is necessary to allow the juice to stand for a short time after pressing in order that the insoluble matter in suspension may settle out. If these precautions be observed, the amount of sugar per *100 c.c.* of juice will be given within the limits of error by the expression

$$y=m\ (Bd-c),$$

where B is the Balling degrees of the juice at the standard temperature.

At 20° C. a very close approximation to the amount of soluble solids per *100 c.c.* of juice can be obtained from the Balling reading by means of the formula

$$\text{Soluble solids per 100 c.c.}=B+0{\cdot}0042\ B^2.$$

Therefore, if the Balling degrees of the juice at 20° C. be determined, the amount of sugar can be obtained directly with a high degree of accuracy by means of the equation

$$y=m\ (B+0{\cdot}0042\ B^2-c).$$

This equation was used to determine the calculated values in fig. 1, and it can be seen how closely the values agree with the observed data.

From Table I, in which the values of m and c are given for five different varieties of grapes, it will be seen that the deviations of m and c from their mean values are not large, and it would therefore seem that, for a given locality at any rate, a general expression may be taken as a sufficiently close approximation for practical purposes. In the present instance, for grapes obtained from Constantia, such an expression would therefore be

$$y=1{\cdot}09\ (B+0{\cdot}0042\ B^2-3{\cdot}83).$$

The agreement obtained by the use of this expression is shown in fig. 1, in which the values are practically coincident with the curve already given. It is, therefore, clear that, since the data are obtained during three differing seasons, this expression is capable of a general application, at least in so far as grapes from one locality (Constantia) are concerned.

It has been shown in the third paper * of this series that the growth constants, such as a, b, and c in the above equations, are distinctly affected by conditions of environment, and on this account it would appear that slightly different values for the constants m and c would be necessary if the above expression were to be applicable to grapes obtained from some locality other than Constantia. In Table II the constants in the case of grapes obtained from Paarl are given. As before, the sugar and soluble solids have been expressed in terms of grams per 100 c.c. of juice.

* Copeman, Trans. Roy. Soc. S. Afr., vol. xiv, 1927.

TABLE II.

Variety.	*m.*	*c.*
Hanepoot . . .	1·11	4·75
Barbarossa . . .	1·11	4·65
Flaming Tokai . . .	1·12	4·75

On comparing these values with the corresponding values for the same varieties from Constantia it will be seen that both m and c are slightly greater in this case. The slightly greater value of m appears to be due to the fact that the initial concentration of soluble solids, prior to the beginning of the ripening process, has a higher value at Paarl than at Constantia. These results confirm the conclusion that the composition of a fruit is affected to a greater extent by environmental factors than by seasonal conditions. In the present case, the use of a particular formula would seem to be dependent more upon the locality from which the grapes were drawn than upon the variety of grape. The generalised formula for Paarl grapes would be

$$y=1{\cdot}11\ (B+0{\cdot}0042\ B^2-4{\cdot}72).$$

The agreement between the observed and calculated values is shown in fig. 1.

At the same time, however, it is seen that the constants for Paarl grapes do not differ to any very large extent from the constants for Constantia grapes, and in practice it would seem that results of sufficient accuracy would be obtained by the use of a formula embodying the average values of all the constants. The general formula, derived in this way, would be in the case of table grapes,

$$y=1{\cdot}10\ (B+0{\cdot}0042\ B^2-4{\cdot}20).$$

The closeness with which this formula agrees with the observed data is shown by means of the dotted line in fig. 1. As the amount of soluble solids increases the discrepancy due to the differences in the initial composition of the juice tends to become less.

It has been shown that there is a very close relationship between the acid and sugar content of the juice, so that if the latter quantity be known it is possible to obtain a close approximation to the value of the acidity. It therefore follows that the process of ripening of grapes may be followed by examining the changes in the sugar content of the juice. The above results show that this may be easily and readily carried out by determining

the Balling degrees of the juice. The degree of accuracy with which the sugar can then be estimated depends upon the particular formula which is used. In practice, therefore, the standards, which are necessary to judge the quality of the fruit, may be fixed by reference to the Balling degrees of the juice. The determination of this quantity is a comparatively simple matter. The temperature of the juice must be determined and care must be taken to allow the juice to stand so that suspended matter may settle out. In other papers * figures have been given for the Balling degrees of the juice by means of which it is possible to judge the maturity of the fruit.

In conclusion, the author would like to thank Dr. B. de C. Marchand for the interest he has taken in the preparation of this paper.

Division of Chemistry,
Cape Town.

* Copeman, Bull. Dept. Agric., Div. of Chem. Ser., No. 75, 1927.

STUDIES IN THE GROWTH OF GRAPES.

Part VI.—The Acid : Sugar Ratio.

By P. R. v. d. R. Copeman, B.A., B.Sc.

(With two Text-figures.)

In the second paper of this series * attention was drawn to the close relationship which exists between the sugar and acid content of the juice of grapes during the process of ripening. It was pointed out that other workers have remarked upon this fact, but that no attempt had previously been made to express this relationship in a definite form. In the above paper, the expression, developed to express this relationship, was derived from two equations which had been shown to express suitably the changes with time which each quantity separately exhibited.

The expression was of the form

$$(y-a)^n=\frac{A}{x}-B,$$

where x and y are the sugar and acid content of the juice respectively. " A " and " B " are constants, related to the magnitude of the final sugar content and to the " half period " respectively. " a " is the minimum acidity of the juice at maturity, while " n " is a quantity depending upon the relative rates at which the acid decreases and the sugar increases during the *ripening period*.

It was shown that the results obtained with the aid of this expression were in very good agreement with the observed values. The constants, which were given, were only applicable to grapes obtained from Constantia, and, owing to the relatively narrow limits of variation in the values of k and K, the growth-rate constants for acid and sugar respectively, the value of the exponent n was found to be practically a constant in the case of grapes from one locality. Seasonal conditions do not, therefore, produce large variations in the growth constants. Gregory † has shown that in the case of barley the positive and negative correlations of net assimilation and

* Copeman, Trans. Roy. Soc. S. Afr., vol. xiv, 1927.

† Gregory, Ann. Bot., 1926, vol. xl, p. 1.

of leaf-growth rates respectively with total radiation provide a mechanism whereby the yield of the plant tends to remain within fairly narrow limits in spite of climatic variations. A similar condition would seem to exist in the case of grapes.

It has been shown in the third paper of this series * that the values of k and K are greatly affected by changes in locality, so that the values for Paarl grapes differ from those for Constantia grapes. It therefore follows that the constants in the above equation must also vary in the same way. The values for the constants in the equation $(y-a)^n=\frac{A}{x}-B$ for Paarl grapes are given in Table I.

TABLE I.

Variety.	n.	a.	A.	B.	Limits of sugar.
Hanepoot . .	0·90	0·40	17·8	0·77	6–24 per cent.
Barbarossa . .	1·40	0·40	15·0	0·89	4–19 ,,
Flaming Tokai .	1·20	0·36	17·2	1·05	4–18 ,,

In this connection the remarks of Caldwell † are particularly significant. This worker states that fluctuations in composition for a variety in the same locality year after year, even with wide differences in seasonal conditions, are very much narrower than for the same variety grown over a wide area under a diversity of soil and cultural conditions. The results, here reported, are completely in accord with these conclusions.

On comparison of the values for the constants given in Table I with the corresponding values for Constantia grapes, it will be seen that the greatest variation is shown in the values for the Hanepoots. This is in accordance with the results obtained for the growth constants, which indicated that the change in environment from Constantia to Paarl produced the greatest effect in the case of the Hanepoots. The least change was noticeable in Flaming Tokai. It is clear that changes in environment are of greater moment than variations in climatic conditions in so far as the composition of the grape is concerned. It would appear that the former have a direct effect upon the " internal " factors governing the growth processes, while the latter tend to affect the " external " factors.

In practice, the application of the equation in the above form presents certain difficulties owing to the presence of the exponent. On this account it was thought advisable to simplify the formula somewhat, even at the

* Copeman, Trans. Roy. Soc. S. Afr., vol. xiv, 1927,

† Caldwell, J. Agr. Res., vol. xxx, 1925, p. 1133.

expense of losing the advantage which may be derived from the possibility of attaching a definite significance to the various constants. The equation, as given, indicates that there is an inverse relationship between the sugar and acid in the juice. It may be expanded in the form

$$y=a+\frac{b}{x}+\frac{c}{x^2}.$$

In this form the inverse relationship is still clear, and it has the advantage that the acidity may be directly determined from a knowledge of the sugar content of the juice. In the fifth paper of this series * it has been shown that such knowledge may be readily obtained from the Balling degrees of the juice. In practice, the equation takes the form

$$y=\frac{b}{x}-\frac{c}{x^2}-a.$$

The values of the constants for the different varieties which have been studied are given in Table II.

TABLE II.

Locality.	Variety.	*a.*	*b.*	*c.*
Constantia	Hanepoot	0·760	29·45	24·93
	Gros Maroc	1·013	38·65	84·10
	Barbarossa	1·296	37·56	80·77
	Waltham Cross	0·491	22·62	27·65
	Flaming Tokai	1·104	35·88	59·18
Paarl	Hanepoot	0·496	20·65	8·41
	Barbarossa	0·600	20·00	32·38
	Flaming Tokai	0·490	15·26	1·75

The data used and the results obtained are, of course, confined to the ripening period, *i.e.* during the period of decrease of acidity. The lower limit of the sugar content is therefore the same in this case as in the results for the previous form of expression. The agreement between the observed and calculated values is shown in fig. 1, where the results of the three seasons for Hanepoot grapes from Constantia are given. In general, those varieties which are characterised at maturity by a high sugar content and a low acidity have comparatively low values for the constants. From Table II it can be clearly seen that changes of environment have a direct effect upon the activity of the plant. The values of the constants for Constantia grapes

* Copeman, Trans. Roy. Soc. S. Afr., vol. xvi, 1928.

are all numerically greater than the values for the corresponding varieties grown at Paarl.

In connection with the relationship between the acid and sugar content of fruit juices, a factor which has been used by a large number of workers in the study of an enormous variety of fruits is the ratio of acid to sugar in the juice. This ratio has generally been regarded as of great importance in evaluating the quality of a fruit. As the fruit ripens the sugar increases and the acid decreases, so that the value of the ratio, acid : sugar, correspondingly

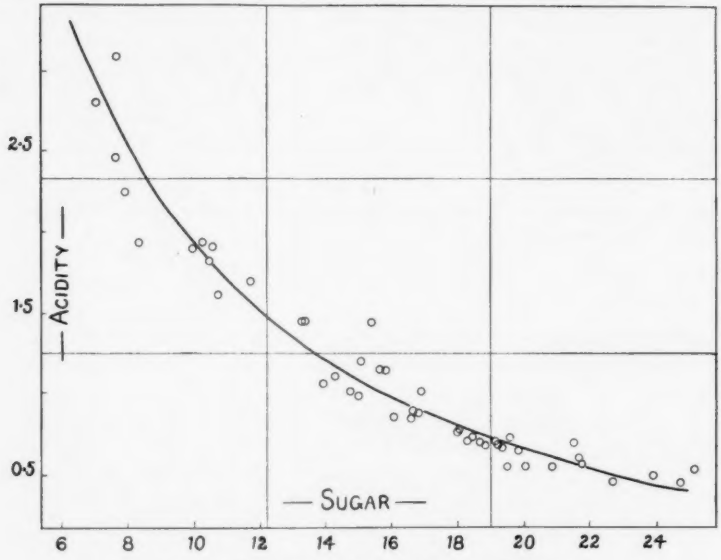

Fig. 1.—Relationship between Acidity and Sugar.

decreases. Finally, at maturity, a balance between these two factors is reached, so that maturity is characterised by a given value for this ratio. Naturally, the magnitude of the ratio is dependent upon the nature of the fruit, but for each fruit the ratio must have a definite value, which determines the character of the crop.

In the present instance, the value of the ratio may be determined at any stage of the ripening process in the case of grapes with the aid of the above equation. If x and y be the sugar and acid content of the juice, the value of the ratio will be given by $r=\frac{y}{x}$.

Therefore

$$rx=\frac{b}{x}-\frac{c}{x^2}-a.$$

In this form the ratio is expressed in terms of the sugar content of the juice, and it is therefore possible, from a knowledge of this factor, to determine either the value of the ratio or the acidity of the juice. This form would appear to be the most suitable for practical purposes. The agreement between the observed and calculated values in the case of the Hanepoot grapes from Constantia is shown in fig. 2. The constants used are those given in Table II for Hanepoots. The same type of formula with

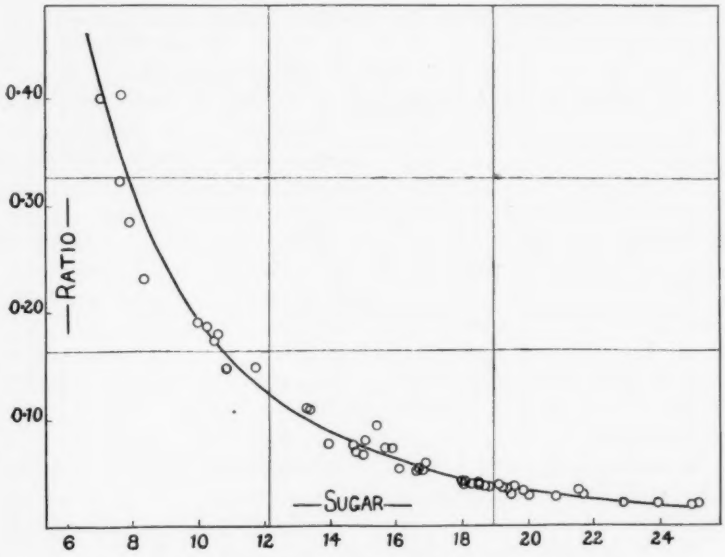

FIG. 2.—Relationship between Ratio (acid : sugar) and Sugar.

the corresponding constants is found to be equally applicable for the remaining varieties both from Constantia and from Paarl.

In practice, of course, each variety at maturity will be characterised by a different value for the ratio of acid to sugar, and this value will be directly correlated with the characteristic taste of the ripe grape. Those varieties which have a high sugar content and a low acidity will have a low value for the ratio at maturity. In this way the different varieties may be grouped according to the value of this ratio. It may be concluded that varieties with a fairly constant ratio at maturity are most to be desired. At the same time it must be remembered that grapes in which the acid content is too low will give a juice with a sweet but somewhat insipid flavour. The value to be attached to the magnitude of the ratio will naturally depend

upon requirements. In the present case the values of the ratio at full maturity are found to be 0·020, 0·050, 0·025, 0·038, 0·030 for the varieties in the order given in Table II. Tietz,* in a paper on "An Important Characteristic of Cape Wines," has given as the lowest ratio for Hanepoot grapes a value of 0·030. This is considerably higher than the values obtained in the present work for the same variety. The sugar content as reported in the above paper is somewhat lower than has been found in the present work for fully mature Hanepoot grapes, and probably the difference in results is due to a difference in the stages of maturity. Caldwell † has pointed out that the average value of this ratio in the case of ripe Concord grapes is 0·067, and, since this is the most generally available grape for the manufacture of commercial grape juice, he concludes that this acid : sugar ratio represents the condition of a grape which people find most agreeable. Assuming that a similar state exists in South Africa, it is found that, for the varieties here investigated, the grapes will be characterised by this value for the ratio when the sugar content is 15·6, 16·0, 14·2, 14·4, 15·2 per cent. for the varieties in the order given in Table II. The corresponding Balling degrees of the juice is found to be 17·0, 17·2, 15·8 15·9, and 16·5 degrees at 20° C. for the varieties in the same order. These results agree very closely with figures which have been independently obtained in other papers.‡ It would seem that, in the case of export grapes, the setting up of a standard with the aid of the Balling reading of the juice would be quite practicable. In such a case the limits would be 16°–17° for the grape juice, according to the variety.

In conclusion, the author would like to thank Dr. B. de C. Marchand for the interest he has taken in the preparation of this paper.

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* Tietz, Brit. and South African Assoc. for Adv. of Sci., 1905, p. 260.

† Caldwell, *loc. cit.*

‡ Copeman, Dept. of Agr. Bull., Div. of Chem. Ser., No. 75, 1927.

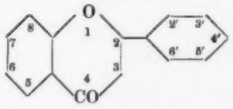
COLOUR AND CHEMICAL CONSTITUTION.

Part XXIII.—The Pigments of Flowers.

By James Moir.

The fascinating question of the meaning and origin of the multifarious hues of flowers is one which must have aroused curiosity long before Science itself came into being, but progress only began to be made about a hundred years ago—as was indeed the case in many other subjects (which interested antiquity but did not develop until fairly recently). The fact, however, that colour changes take place in blue and purple flowers when they are "smoked" must have been discovered in the sixteenth century, although the explanation—that it is due to ammonia and similar alkaline gases in smoke—is more recent.

About thirty years ago A. G. Perkin commenced his classic investigation of the yellow pigments occurring in petals (and in medicinal roots), and in course of time isolated some eight or nine compounds, all possessing the same chemical skeleton, but differing from one another in the number of hydroxyl groups which are attached to that skeleton. This number is seven in the highest members, and *nil* in the parent substance (or skeleton) flavone or 2-phenylbenzopyrone :

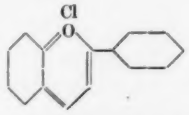


Most of the pigments have hydroxyls in the 5 : and 7 : positions, and are thus derivatives of phloroglucinol. Flavone itself occurs sometimes in Nature as a loose powder on certain primulas.

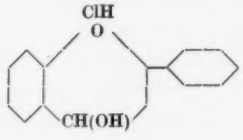
About twenty years ago Willstaetter commenced a similar investigation of the pigments of higher colour, viz. those of scarlet, rose, purple, and blue shades, and after surmounting great difficulties due to their sensitive character, proved that they also were all of them hydroxyl derivatives of a parent skeleton, now known as flavylium, which is a positive ion like ammonium, and probably exists in Nature * as tartrate, although for

* *I.e.* in its natural hydroxylated derivatives.

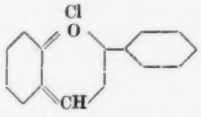
simplicity of writing it is formulated as chloride. Chemically speaking, it is 2-phenylbenzopyrylium chloride :



It is easily seen that flavylium is a reduction-product of flavone, for if the CO group of the latter is converted into CH(OH) and HCl added to the opposite oxygen (the pyrone oxygen), the product

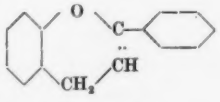


can lose water and become



which is another way of writing flavylium chloride.

As an alternative we may suppose the yellow (or flavone) pigments to be oxidation-products of the blue ones, and we thus arrive at the rather marvellous result that in nearly all cases Nature is using the same chemical proto-skeleton flavene



as the foundation of her pigmentary work.

Willstaetter in the end synthesised pelargonidine (3–5–7–4′-tetrahydroxyflavylium), which occurs in geranium petals as a glucoside, by purely chemical methods, and more recently Robinson, with Pratt and other collaborators, has invented a general method whereby all may be synthesised. I have used this method to obtain members of the series which do not occur in Nature but are theoretically important.

Soon after the invention of the spectroscope eighty years ago it was discovered that many blue and purple and red petals contain the same pigment (cyanine), and that the shade depends on the acidity or alkalinity of the sap. Pink and blue hydrangeas constitute a case in point, the blue variety being encouraged by placing metallic iron in the soil. The iron acts

probably merely because $Fe(OH)_2$ is a strong base and not so much as a plant food. In any case the complexity of flower shade does not involve a great complexity of chemical substances, since any one substance may assume two or more hues (like a chemical "indicator") when its solution is changed from acid to alkaline.

The whole of the blue, violet, purple, and rose flowers can, for example, be turned red (of various shades) by dipping in alcohol containing some acid for a few minutes.

I have given a critical discussion elsewhere of the question, What is the true theory of the production of colour? (see J. Chem. Soc. London, August 1927), the conclusion being that it is certainly of molecular, not atomic, origin, and that the height of colour (*i.e.* position of the absorption band) depends more or less directly on the distance between two active positive centres in the molecule, two oxygen atoms, or two nitrogen atoms, or one oxygen and one nitrogen atom, or one oxygen (or nitrogen) and one unsaturated carbon atom.

The relationship is such that this distance expressed in Ångstrom units and multiplied by 800 gives, roughly, the position of the absorption band expressed in the same units. I have published some mathematics based on classical dynamics in explanation of this, but it appears probable that the same result can be reached by means of the mathematics of the quantum theory, which would be much more satisfactory in view of the triumphs of that theory in explaining emission spectra.

In the meantime, therefore, I content myself with tabulating my experimental work on the flower pigments (anthocyans), so as to show, as in the last nine parts of this work, that:

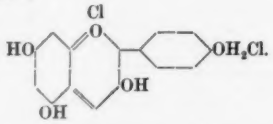
(1) there is a regular gradation of shade as the anthocyan is simplified down to its parent substance by removing the hydroxyl groups one by one, but

(2) the removal of hydroxyl from certain positions has much more effect than from other positions, *i.e.* the 4′ and 7 positions are the most important ones for heightening the colour.

In presenting this tabular summary I remark that it is inexcusable that this interesting subject should have been rendered indigestible by the pioneers through the use of a barbarously complex terminology most difficult to follow and remember. I should also mention that names ending in *-idine* are used to signify plant pigments free from glucose or other sugar, whereas those ending in *-ine* are the pigments as they actually occur in petals (with $-O{\cdot}C_6H_{11}O_5$, for example, instead of a free hydroxyl group). I propose also for the present to omit the class of yellow pigments from the discussion, as they have not yet been accurately spectroscoped.

Table I describes the compounds and their colours in the acid (usually

red) state, in which the compounds are probably *double* oxonium chlorides; for example, pelargonidine is



It is probable also that the differences exhibited in this table are merely differences due to "loading" with *inactive* hydroxyl groups, because in the presence of free acid the OH group is non-ionised, *i.e.* never acts as $O^- + H^+$.

It is, however, possible that the second HCl of the doubly acid system is not on hydroxyl at all, but on one of the three pairs of double-bonded carbon atoms. This supposition is *necessary* in the case of the parent substance (see the paper of Perkin, Robinson, and Turner referred to later on).

TABLE I.

	Name.	Relation to Parent Substance.	Central λ in Acid Water.	Colour.
1.	Flavylium (chloride)	Parent substance	392	Pale yellow.
2.	Resochrysinidine	7-hydroxy	435	Yellow.
3.	Protopelargonidine	4′ ,,	438	,,
4.	Protocyanidine	3′ : 4′-dihydroxy	about 440 broad	,,
5.	Chrysinidine	5 : 7- ,,	about 430	,,
6.	Resogalanginidine	3 : 7- ,,	,,	,,
7.	Resoapigeninidine	7 : 4′- ,,	465	Orange.
8.	Galanginidine	3 : 5 : 7-trihydroxy	about 460	,,
9.	Resopelargonidine	3 : 7 : 4′- ,,	about 470	,,
10.	Apigeninidine	5 : 7 : 4′- ,,	465	,,
11.	Fisetinidine	3 : 7 : 3′ : 4′-tetrahydroxy	about 475 broad	,,
12.	Luteolinidine	5 : 7 : 3′ : 4′- ,,	485	,,
13.	Pelargonidine	3 : 5 : 7 : 4′- ,,	500	Red-orange.
14.	Cyanidine	3 : 5 : 7 : 3′ : 4′-pentahydroxy	527 (and 496 faint)	Rose.
15.	Delphinidine	3 : 5 : 7 : 3′ : 4′ : 5′-hexahydroxy	545 (,, ,,)	Violet-rose.

The names of Nos. 2, 3, 4, 6, 7, and 9 have been invented by myself to bring out chemical analogies to those better known. This terminology follows that invented by Heap and Robinson (J. Chem. Soc. London, 1926, 2337) to deal with the corresponding yellow oxidised colours derived from flavone.

Substances 2, 3, and 7 are new and were made by applying the method of Pratt and Robinson (*loc. cit.*, 1925, 1132 *et seq.*) to salicylaldehyde plus 4′-hydroxyacetophenone, and to β-resorcaldehyde plus (*a*) acetophenone and (*b*) its 4′-hydroxy compound. The oxonium chlorides were isolated as chocolate-coloured powders by means of their insolubility in ether and

solubility in acid water. Sometimes perchlorates were found to be more easy to obtain than chlorides.

Although hydroferrichlorides are easily isolated, they cannot be used for spectroscopy on account of the intrinsic colour of the iron present. The work of Robertson and Robinson (*loc. cit.*, 1926, 1716 and 1953) has a bearing on substances 4, 7, and 9. The parent substance has been known a long time (Perkin, Robinson, and Turner, *loc. cit.*, 1908, 1110). The figures for Nos. 4, 5, 6, 8, and 9 are estimates of my own, made from the authors' description of the shades of the solid substances and their behaviour on solution, and may possibly be wrong by 10 or 15 units, but are necessary for completeness of tabulation.

A study of the numerous synthetic methyl-ether derivatives described by Pratt and Robinson (*loc. cit.*, 1922, 1578, and 1923, 749) and of the natural ones, paeonidine and acacetidine, has convinced me that the OCH_3 group has only a little more effect in *acid* solution than the OH group. It is a mere "load" like the acid OH group. Paeonidine is the 3 : methoxy derivative of luteolinidine, and is about fifty units higher in colour; pelargonidine is the 3 : hydroxy derivative, and lies intermediate in colour between paeonidine and luteolinidine.

Secondly, it has been mentioned at the beginning that the flower pigments change colour when the solvent changes from acid to nearly neutral.

Table II exhibits the absorptions and colours of the more important of them in a medium of reaction *p*H5 to *p*H6.

TABLE II.

Name.	Reference to Table I.	Central Absorption.	Colour.
Resochrysinidine	No. 2	487	Apricot-orange.
Protopelargonidine	No. 3	481	,,
Resoapigeninidine	No. 7	489	,,
Galanginidine	No. 8	495	Salmon.
Apigeninidine	No. 10	495	,,
Luteolinidine	No. 12	510	Pink.
Pelargonidine	No. 13	534	Rose.
Cyanidine	No. 14	545 and 575	Violet.
Delphinidine	No. 15	545 and 590	Blue.

It should be noted that the *parent substance* under these circumstances is *insoluble*, and probably of only very low absorption.

In order to attempt an explanation of all these facts I have brought into the field the analogous nitrogen compounds.

It is well known that flavylium chloride is the oxygen-analogue (or

isologue, according to Werner *) of the hydrochloride of 2-phenylquinoline.

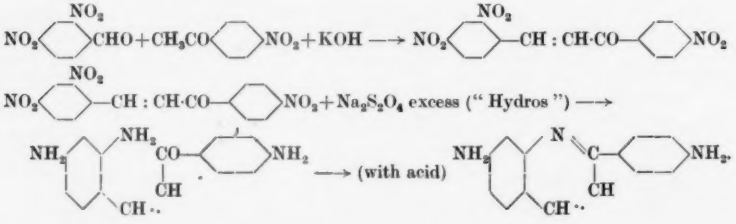
Isology involves the replacement of NH_2 by OH, or NH by O, or N by OCl, so it is clear that polyaminoquinolines are strictly isologous with anthocyanidines, and therefore throw light on the cause of the colours and colour changes. One such substance is the well-known (but obsolete) yellow dye flavaniline, the 4-methyl derivative of 4′-aminophenylquinoline. Pratt and Robinson (*loc. cit.*, 1922, 1579) appear to have expected marked colour in quinoline compounds without amino groups, but this appears to me unreasonable.

I have prepared a small number of these amino-quinolines, and Table III reports their absorptions in acid solution (*p*H5).

TABLE III.

Name.	Isologous Substance in the Flavylium Series.	Central Absorption.	
2 : phenylquinoline	Parent substance .	358 (straw-yellow).	
7 : amino-2 : phenylquinoline . .	Resochrysinidine . .	426	Deep yellow with green fluorescence.
4′ : „ „ . . .	Protopelargonidine .	407	
7 : 4′ : diamino-2 : phenylquinoline .	Resoapigeninidine . .	430	
5 : 7 : 4′ : triamino-2 : „ .	Apigeninidine . .	440	

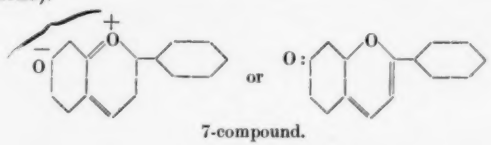
I also examined 4′ : dimethylamino 2 : phenylquinoline, which is "high" in colour (λ 430) and 4′-hydroxy-2 : phenylquinoline, which is very pale (λ 377 in acid and λ 367 in NaOH). The synthesis of these new substances was done as follows :—



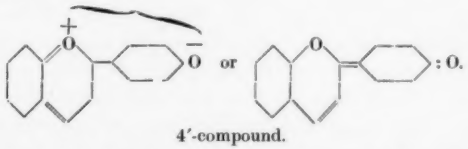
Comparing the nitrogen compounds one by one with the oxygen compounds we find the absorptions from 10 to 20 per cent. lower ; we also find that the quinoline compounds are not changed when the medium changes from acid to near neutrality. It is of great importance that the two classes do differ, because both types of molecule are of the same size and structure, according to Bragg's discovery of the identity in size of oxygen and nitrogen

* Berichte, 1901, 3300.

atoms (although it is true that quadrivalent oxygen has not yet been measured). A probable explanation of the "rise" in colour of the oxonium (over the ammonium) type is that the mutually combined configuration is possible in the former but not in the latter. This is in fact Willstaetter's explanation of the origin of the colours of the anthocyanidines in their neutral condition (see also Buck and Heilbron, *loc. cit.*, 1922, 1203, and 1923, 2525).



7-compound.



4′-compound.

Thirdly, we have the fact that the plant pigments show a third shade in definitely alkaline solution.* In this case the phenomenon is due to the hydroxyl groups acting as positive centres and not as "loads," as in acid solution. This case is therefore on all fours with the behaviour of "dicyclic" substances, as explained in Part XIV, the colours being much higher than in acid solution and the changes apparently following the same rules as in the triphenyl-carbinol series.† Table IV gives my observations of their absorptions.

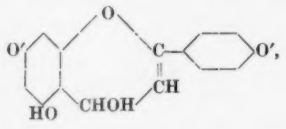
TABLE IV.

Name.	Reference to Table I.	Central Absorption.	Colour.
Protopelargonidine	No 3	538	Rose.
Resoapigeninidine	No. 7	540	,,
Galanginidine	No. 8	about 540	Violet-rose.
Apigeninidine	No. 10	,,	,,
Fisetinidine	No. 11	about 580	Violet.
Luteolinidine	No. 12	,,	,,
Pelargonidine	No. 13	587	,,
Cyanidine	No. 14	600	Blue.
Delphinidine†	No. 15	690 and 590	Blue (slightly alkaline). Green (strongly alkaline).

* Some pass through a colourless phase (pseudo-base) when exactly neutral.

† Delphinidine behaves all over very like catechol-sulphophthalein in having five colours.

To explain these it is necessary to assume that the oxonium configuration has disappeared in the presence of alkali, so that the substances have the configuration of hydrols (carbinols), and are thus analogous to dihydroxybenzhydrol, phenolphthalein, and other dicyclic-coloured substances. Thus pelargonidine, which is violet when *slightly* alkaline, may then be



and thus owe its high colour to CHOH plus *two* ionised hydroxyls, just as dihydroxybenzhydrol does. *Excess* of alkali bleaches the violet to pale yellow, and then, no doubt, the ring is opened at the central oxygen and the compound has become a simple straight-chain one.

It is clear from the fact that resoapigeninidine and protopelargonidine have colours nearly as high as those of pelargonidine (confining oneself to slightly alkaline solutions) that either the 4′ : or the 7 : hydroxyl suffices for the effect; when either of these is present, the addition of 3 : or 5 : hydroxyl only broadens the band without moving it much. When, however, the 4′ : and 7 : hydroxyls are both absent, the 3 : hydroxyl has a marked effect (see also Pratt and Robinson, *loc. cit.*, 1923, 748). More work is required to settle what is the effect of the 5 : hydroxyl in general. In the acid phase (as already said) there is less difference between the effects of the different hydroxyls. Buck and Heilbron (*loc. cit.*, 1922, 1203) have discussed this point so far as the evidence up to five years ago went. They had synthesised compounds corresponding to the anthocyanidines but differing by having the group $-CH:CH.C_6H_4X$ instead of $-C_6H_4X$ (where X is an auxochrome), *i.e.* styryl-benzopyrylium salts instead of phenyl-benzopyrylium salts. This increase in distance between the auxochrome and the other active centre of the molecule (in this case the oxonium atom) caused, as in other cases, a striking rise in the " height " of the colour. Their very remarkable dimethylamino compound (*loc. cit.*, 1922, 1204, and 1923, 1395) is in its way more striking even than delphinidine. I have thought it worth while, therefore, to collect together all the examples of the effect of lengthening the chain joining auxochrome to active centre (*hapton* in my own terminology). Mills' carbocyanines and Koenig's vinylene compounds are other classic examples. Koenig uses the term *streptomonovinylene* for the interposition of —CH : CH— in a chain—changing . CH : into . CH : CH . CH :, and *streptodivinylene* for the change of . CH : into . CH : CH . CH : CH . CH : . I have shown in one or two cases that a single CH (or CH_2) can be interposed —with more than half the result of a vinylene interposition.

TABLE V.—*Effect of Chain-lengthening.*

	Name.	Empirical Formula.	Central Absorption.	Colour.
1.	4′ : dimethylamino-flavylium (salts).	$C_5H_6OCl.C_6H_4NMe_2$	517	Pink.
2.	4′ : dimethylamino - 2 : styryl-benzopyrylium (salts).	$C_9H_6OCl.CH:CH.C_6H_4NMe_2$. . .	688 and 634*	Green.
3.	4′ : dimethylamino-2 : phenyl-quinoline (salts).	$C_9H_7NCl.C_6H_4NMe_2$	430	Deep yellow.
4.	4′ : dimethylamino-2 : benzyl-1 : methylquinoline (salts).	$C_9H_6NMe.CH:C_6H_4:NMe_2Cl$. . .	506	Salmon.
5.	4′ : dimethylamino-2 : styryl-1 : methylquinoline (salts).	$C_9H_6NMe:CH.CH:C_6H_4:NMe_2Cl$ . .	525†	Rose.
6.	4′ : dimethylamino - 2 : styryl-1 : methylpyridine (salts).	$C_5H_4NMe:CH.CH:C_6H_4:NMe_2Cl$ . .	465	Orange.
7.	2 : 2′ dimethyl - pseudoiso - cyanine (salts).	$C_9H_6NMe:CH.C_9H_6NMeCl$ . . .	525	Rose.
8.	"Pinacyanol" . . .	As above, with $(CH)_3$ for CH . . .	607	Greenish-blue.
9.	Dimethyl-indocyanine (salts) .	$C_8H_5MeN.CH:C_8H_5MeNCl$ . . .	482‡	Apricot-orange.
10.	Streptomonovinylene derivative of above.	As above, with $(CH)_3$ for CH . . .	555‡	Violet-rose.
11.	Streptodivinylene derivative of No. 9	As No. 9, with $(CH)_5$ for CH . . .	658‡	Emerald-green.
12.	"Dimethylcarbethoxylpyrryl-cyanine."	$CO_2EtC_4HMe_2N.CH:C_4HMe_2N(CO_2Et)Cl$.	464‡	Orange.
13.	Streptomonovinylene derivative of above.	As above, with $(CH)_3$	567‡	Red-violet.
14.	Streptodivinylene derivative of No. 12.	As No. 12, with $(CH)_5$	663‡	Emerald-green.
15.	4 : 4′ dimethylcyanine (salts)	As No. 7, but 4–4′ union . . .	590	Blue-violet.
16.	Kryptocyanine (salts) . .	As above, with $(CH)_3$	711	Green.
17.	"Diethylthiocyanine" . .	$C_7H_4SNEt:CH.C_7H_4SNEtCl$ . . .	423§	Yellow.
18.	"Thiazole-purple" . .	As above, with $(CH)_3$	559‖	Violet-rose.

The unannotated observations are my own. By the way, I find that Buck and Heilbron, who suppose (*loc. cit.*, 1922, top of p. 1204) that the spectrum of their substances does not change when the colour changes from red to blue-green, are in error on this point. The greenish phase has a very

* Buck and Heilbron, *loc. cit.*, 1923, 1395.
† Hamer, *loc. cit.*, 1924, 1357; λ is 525 in water and 532 in alcohol.
‡ Koenig, Zeit. f. angew. Chemie, 1925, 743.
§ Mills, J. Chem. Soc., London, 1922, 465.
‖ Mills, *loc. cit.*, 1922, 462; also Koenig, Zeit. angew., 1925, 743.

strong band far up in the red, which they have overlooked; λ is 675 for the 4′ compound, and about 700 for the 3′ : 4′-compound.*

Finally, although it has no bearing on the anthocyans, I have thought it useful to tabulate what is known of the effect of replacing the quinoline ring by the benzothiazole, benzoxazole, and benziminazole rings.

TABLE VI.—*Effect of putting S, O, and NH for ring* —CH : CH.

	Name.	Formula.	Absorption.	Colour.
1.	Diethyl-ψ-isocyanine . . .	$C_9H_6NEt : CH . C_9H_6NEtA$ . .	530	Rose.
2.	„ -thiocyanine . . .	As above, with S for C_2H_2 of ring .	423	Yellow.
3.	Thiazole-purple	See Table V	559	Violet-rose.
4.	Oxazole-yellow	As foregoing, with O for S . .	485	Orange.
5.	"Streptovinylene-tetramethylindocyanine."	As No. 3, with CMe_2 for S . .	400	Yellow.
6.	Dimethylaminostyryl-quinoline† .	$C_9H_7N : CH . CH : C_6H_4NMe_2Cl$.	520	Salmon.
7.	„ „ -benzothiazole†	As above, with S for C_2H_2 of ring.	538	Rose.
8.	„ „ -benzoxazole† .	As No. 7, „ O „ „ .	420	Yellow.
9.	„ „ 1 : methylbenziminazole†	„ „ NMe „ „ .	410	„

The data in this table are taken from the literature in the first five cases and refer to alcoholic solution: the others are my own and refer to water solution in presence of weak acid.

I may mention in conclusion that I have now, after twelve years, succeeded in going over the entire field of coloured substances, with some unimportant exceptions: it remains to see if a mathematical explanation of the whole of the data can be found consonant with current (*i.e.* "quantum") ideas on the absorption of radiation.

I wish to thank Dr. Frances Hamer of London for nearly all of the literature-references required for this paper.

* These are hydroxy, not dimethylamino compounds.

† From NMe_2CHO (and strong potash) on quinaldine and the other three methyl derivatives.

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SOME NEW SPECIES OF CURCULIONIDAE FROM SOUTH AFRICA AND SOUTH-WEST AFRICA.

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S.A. Museum, Cape Town.

(With Plate XVII.)

The following descriptions of new species of *Curculionidae* are from material collected in South Africa, Rhodesia, and South-West Africa by collectors in different parts of the country and by members of the Museum staff on their expeditions to Damaraland, Ovamboland, and the Kaokoveld from 1916 to 1926. Among those described in this paper are some remarkable forms and also some interesting species from the southern Kaokoveld. It is interesting to note that the two species of *Phacemastix* are found in widely separated areas: *P. kaokoenis* sp. nov. being found in the southern Kaokoveld on the north-west coast of South-West Africa and also in Zululand on the east coast, while *P. picta* sp. nov. is found in the north-western Transvaal, at Kimberley, and as far north-west in South-West Africa as Namakunde near the Kunene River and Angola. This distribution in widely separated localities applies to many other species of *Curculionidae* and also to other families of beetles that have formerly been described only from either the east or the west coasts, whereas the semi-arid sand or dune formations of south-western Africa again has no representatives on the east coast, where these conditions do not prevail.

I wish to express my thanks to the members of the Museum staff and to the private collectors who have contributed to the *Curculionidae* in the S.A. Museum collections, and also to Dr. Guy A. K. Marshall of the Imperial Bureau of Entomology, London, for valuable advice in the description of the new species.

The figures are free-hand drawings by the author. S.A.M.=South African Museum and (M. Exp.)=Museum Expedition. In this paper altogether twenty-five new species are described belonging to the following sub-families and genera :—

Curculioninae { Tribe SOMATODINI, *Oncylotrachelus rhodesianus* sp. nov., Rhodesia.
„ „ „ *lobaticollis* sp. nov., Cape.
Tribe *Hipporrhinini*, *Hipporrhinus fucosus* sp. nov., „
„ *planithorax* sp. nov., „
„ *silvaticus* sp. nov., „
„ *solitarius* sp. nov., „
„ *truncus* sp. nov., „
„ *vastivagus* sp. nov., South-West Africa.
Solenorrhinus granulosus sp. nov., Cape.
„ *proteaphilus* sp. nov., „
Origenes pulcher sp. nov., „
Epichthonius rastricollis sp. nov., „

Balaninae :—*Balaninus transvaalensis* sp. nov., Transvaal.
„ *valens* sp. nov., Transvaal, Natal.

Ambatinae :—*Phacemastix kaokoensis* sp. nov., South-West Africa, Zululand.
„ *picta*, sp. nov., South-West Africa, N. Cape, Transvaal.

Cryptorrhynchinae :—*Ocladius bimaculatus* sp. nov., South-West Africa.
„ *rupicolus* sp. nov., „ „

Cossoninae :—*Mesoxenomorphus luridus* sp. nov., Cape.
Porthetes dissimilis sp. nov., „

Erirrhininae :—*Hypsomus bellulus* sp. nov., „
„ *lepidus* sp. nov., „
„ *rugosipennis* sp. nov., „

Rhyparosominae :—*Rhyparosomus admonitus* sp. nov., Cape.

Otiorrhynchinae :—*Sciobius asper* sp. nov., „

Sub-fam. **Curculioninae.**

TRIBE SOMATODINI.

Gen. ONCYLOTRACHELUS Schoen.

Oncylotrachelus Schoenherr, Gen. Curc., vii, i, p. 86, 1843.

O. rhodesianus sp. nov. Type S.A.M.

Oblong, black, the antennae, under surfaces and legs dark ferruginous. Head short, very convex, closely rugosely punctured, each puncture with a fine pale seta, forehead sloping; eyes rotundate, dark brown; rostrum slightly narrower and shorter than head, incrassate, with the upper surface

rugosely striolate, sulcated centrally, the sulcus becoming deeper apically; antennae with the scape slightly sinuate and reaching the prothorax, with funicle and club yellowishly sericeously pubescent, club oblong and acuminate; prothorax broader than long, broadest posteriorly, narrowed and slightly transversely constricted apically, with the apical margin subtruncate, laterally rotundately ampliated, posterior basal angles subrectangular, posterior margin deeply sunk below the level of the disk, with the upper surface flatly convex, slightly transversely depressed before the base, closely set with flat, rounded, and smooth tubercles, each with a pale depressed seta, with an indication of an obsolete central line or furrow; elytra oval, convex, narrower basally than the prothorax, broadest at about the middle, the sides rounded and the apices conjointly obtusely rotundate, striae with regular rows of punctures, separated by small shining granules, the intervals with rows of shining setiferous tubercles; intervals 1, 3, 5, 6, and 7 with larger tubercles; intervals 1, 3, and 5 basally more or less costate and distinctly punctured, with the tubercles more distant and more distinct beyond the middle and on the declivity; intervals 2, 4, and 6 with the tubercles disappearing at the summit of the declivity; interval 3 is connected apically with 9, the intramarginal row below; interstices with sparse ashy-grey scaling; apices of tibiae and under surfaces of tarsi with pale yellowish sericeous pubescence; ♂ smaller than ♀, with the legs less stout, with the sides of the elytra less rounded, and the apex of the last abdominal segment more truncate, less pointed.

From 1 ♂ and 1 ♀.

Length (excl. head and rostrum), 8–11 mm.

Breadth, 3½–5 mm.

Hab.—S. Rhodesia—Salisbury (R. Tucker).
Umtali (A. Bodong).

This species resembles *punctifrons* Pér., but differs by its smaller size, the subrectangular posterior basal angles of the prothorax, the intervals on the elytra being less costate and not so closely tubercular on the declivity and also by the absence of even small tubercles on intervals 2, 4, and 6 towards the apex on the declivity.

O. lobaticollis sp. nov. Type S.A.M.

(Pl. XVII, figs. 9 and 9*a*.)

Oblongo-ovate, the head, prothorax and under surface black, more or less shining, with the antennae, the dorsal surfaces of the elytra and the legs deep piceous or ox-blood red; head broad, convex, densely punctured, each puncture with a fine depressed white seta, forehead longitudinally slightly impressed; eyes subglobular, more or less prominent, brown;

rostrum a little shorter and narrower than the head, incrassate, straight, with a medial smooth line becoming sulcate anteriorly and passing into an anterior smooth shining apical part, with the upper surface densely punctured, whitishly setose, longer and more hair-like apically and laterally, with the scrobes deep anteriorly, arcuate and vanishing posteriorly under the eyes; antennae long, slender, yellowishly sericeously setose, with the scape long, slightly curved, abruptly clavate apically, extending a little beyond the anterior margin of the prothorax, with the funicular joints clavate apically; joint 1 elongate and slightly longer than 2; 3, 5, 6, and 7 subequal, slightly shorter than 4; club elongate, acuminate; prothorax (with the exclusion of the dorso-lateral lobes) about as broad as long, about $1\frac{2}{3}$ times as broad across the dorso-lateral lobes as long, slightly constricted intramarginally laterally near the apex, with the apical margin feebly sinuate dorsally, transversely dilated basally, with the posterior part abruptly declivous and the basal margin feebly rotundate, with the sides slightly rounded, with the upper surface densely punctured, each puncture with a fine white depressed seta, broadly depressed and bordered on each side by an elevated, backwardly directed and slightly outward projecting wing-like lobe, whose anterior raised and carinate edge curves inwards, beginning intramarginally near the apex on the antero-lateral intramarginal constriction, and whose posterior part is free, lobate, and slightly laterally compressed; elytra ovate, with the shoulders sloping and broadly rounded, the sides rounded, broadest just before the middle, with the margins abruptly inflexed and the posterior part acuminate, with the upper surface convex, gradually sloping posteriorly, basally convexly dilated and raised above the prothorax, medially depressed in the scutellar region, with regular rows of punctures, each with a white depressed seta; intervals plane, coriaceous, with intervals 2 and 4 narrower than the others, with interval 1 feebly convex on the declivity, with interval 2 narrowed on the declivity and meeting 9 near the apex, with interval 3 convexly dilated basally and meeting 8 apically, with interval 4 meeting 6 posteriorly and interval 5 stopping in the angle so formed; interstices with a yellowish sericeous pubescence, more distinct basally and along the suture, where it is interrupted on the first row of punctures and on interval 2 on each side by a row of distant smooth shining patches; legs with yellowish hair-like setae, with a yellowish sericeous pubescence on the apices of the tibiae and the under surfaces of the tarsi; femora markedly clavate; posterior tarsi long, with joint 3 slightly broader than the others, joint 1 longer than 2, 2 and 3 subequal.

From a single specimen.

Length (excl. head and rostrum), $8\frac{2}{3}$ mm.

Breadth (acr. prothoracic lobes), $3\frac{2}{3}$ mm.

Breadth (acr. elytra), 4½ mm.

Hab.—Cape Colony—Caledon (Dr. F. Purcell).

This remarkable species has a distinct facies of its own, but it undoubtedly belongs to the genus *Oncylotrachelus*.

Tribe HIPPORRHININI.

Gen. Hipporrhinus Schoen.

Hipporrhinus Schoenherr, Disp. Meth., p. 85, 1826.
„ Lacordaire, Hist. Nat. Insect. Coleop., vi, p. 325, 1863.
„ Marshall, P.Z.S. Lond., i, p. 13, 1904.
Bronchus Germar., Mag., ii, p. 340.

H. fucosus sp. nov. Type S.A.M.

(Pl. XVII, fig. 1.)

Head punctuated on vertex, vertex convex and covered with fulvous scales, forehead smooth and flattened, with a central stria, with the anteocular furrows deep laterally in front of eyes; rostrum not cut off from head at base, but much elevated dorsally, shorter than head and prothorax, slightly longer than prothorax, thick and curved, with the upper surface convexly elevated, furrowed, plane on the apex, with a central smooth line becoming raised and carinate more apically, sides of furrow rugosely punctured and with scattered pale scales, with the lateral sulci broad and distinct, the upper pair uniting at base and covered with scattered pale scales, with the scrobes deep, slightly curved and directed beneath base of rostrum, with the inferior basal furrow shallow; antennae with fine elongated pale scales, with the scape not quite reaching lower anterior margin of eye and joint 1 of the funicle very slightly longer than 2; prothorax broader medially than long, about as broad basally as apically, with the sides rounded and the ocular lobes feeble, with the upper surface slightly convex, closely set with small rounded bare tubercles, somewhat larger and flattened towards the base, each with a pale depressed seta, leaving a central space containing a well-developed flattened carina, with dense brown scaling on the interstices; elytra ovate, shoulders prominent, almost rectangular, sides slightly rounded, broadest about the middle, apical processes obsolete in specimen, with the upper surface convex, with rows of small punctures; intervals 1, 3, 5, and 7 strongly costate and with catenulated rows of small depressed tubercles which are more separated laterally and near apex; interval 1 beyond middle and intervals 2, 4, and 6 with rows of minute shining granules bearing pale brown depressed setae, those on

interval 2 ceasing beyond middle; basal half of intervals 1 and 3 more carinate than tuberculate; interstices with dense brown scaling; legs with sparse pale scaling; posterior tarsi with the 3 joints of about the same width, 2 and 3 subequal in length and 1 longer.

From a single ♀.

Length (excl. head and rostrum), 15½ mm.

Breadth, 7 mm.

Hab.—Cape Colony—Caledon (Dr. F. Purcell).

This species is allied to *H. delectans* Hrbst., from which it differs by the deeply furrowed rostrum, the more numerous tubercles, which are not elevated, and the well-developed carina on the prothorax, as well as the presence of distinct rows of granules on intervals 2, 4, and 6.

H. sjöstedti Mshl. (♀).

(Pl. XVII, fig. 2.)

Marshall, P.Z.S. Lond., i, p. 131, 1904.

The ♀ of this species is characterised by having a prominent conical tubercle at the summit of the declivity on interval 3.

H. planithorax sp. nov. Type S.A.M.

Black, more or less shining.

Head convex, closely rugosely punctured, each puncture with a small depressed pale seta, forehead more coarsely and rugosely punctured, with a shallow central foveate depression and with some long dark setae laterally on each side; eyes somewhat depressed, surrounded by an impressed line; rostrum not incised at base, slightly shorter than prothorax, stout, very slightly curved, very slightly dilated apically, with the upper surface slightly convex, rugosely punctured, the punctures with long dark suberect setae, with 3 distinct smooth carinae, with the lateral sulci separated by a less distinct carina, the upper ones converging basally there becoming indistinct, with the scrobes deep, lateral and more or less straight, with the inferior basal furrow absent; antennae shining, deep piceous, with the scape clavate, extending beyond eyes and reaching the anterior margin of prothorax, with fine white setiform scaling and long dark setae on clavate part, the funicle with fine white setiform scaling and long dense dark setae (longer and denser in ♂), with joints 1 and 2 subequal and longer than the subequal joints 3 and 4, joints 5 and 7 subequal and slightly shorter than 6, the club fuscous; prothorax much broader than long, broader basally than apically, with the sides greatly rounded, broadest at about the middle, the ocular lobes moderately developed, with the dorsal apical margin

feebly sinuate and the basal one truncate, with the upper surface plane, closely set with flat rounded shining tubercles, each with a short dark depressed seta, leaving a very shallow central furrow containing a short narrow carina abbreviated basally and apically, with a small indistinct spot of white scales on each side at about the middle, the pleurae with a few scattered white scales ; elytra oblong-ovate (♀), narrower more elliptical (♂), broadest at about the middle, posteriorly more acuminate in ♀, the shoulders rounded and prominent, apical processes absent, with the upper surface slightly convex, with regular rows of punctures separated by granules, with the intervals slightly elevated and with rows of small shining tubercles becoming more conical and separated towards the apex, each with a dark depressed seta becoming slightly longer towards apex ; intervals 1 and 2 and often 3 with the tubercles more elongate, more or less catenulate before the middle, and more conical and separated beyond the middle ; intervals 8 and 9 each with a row of very small separated tubercles ; interstices with a few scattered spots of white scaling laterally and some tawny spots and setiform scaling towards apex ; under surface more or less scabrous, with fine pale setiform scaling and dark setae and the apical margin of the mesosternum laterally with a row of large flat white scales ; legs stout, with fine, scattered, pale, setiform scales and dark setae ; femora clavate, rugosely punctured basally and more coarsely apically ; the tibiae scabrous, with long dark setae below, the anterior ones dentate below and the hind ones more arcuate in ♂ ; posterior tarsi with joint 3 the broadest, 1 broader than 2, with 1 about as long as 2 and 3 together, and 2 and 3 subequal. From 2 ♂♂ and 2 ♀♀.

Length, 12½–13⅓ mm.

Breadth, 5–6 mm.

Hab.—Cape Colony—Langebergen (Riversdale) (Dr. K. Barnard).

This species belongs to the *arenarius* Fhs. and *seriegranosus* Ghl. group with the scape extending beyond the eyes and the rostrum not incised at the base.

H. silvaticus sp. nov. Type S.A.M.

(Pl. XVII, fig. 3.)

Head convex, punctured, and plicated, forehead sloping, granularly plicated, anteocular furrows absent, with a slight foveate depression at base of rostrum ; rostrum not incised at base, as long as prothorax, slightly curved, with the upper surface slightly convex, with 5 narrow carinae, the 3 median ones being smoother and distinct, with the interspaces rugosely punctured, with the upper lateral sulci passing into the foveate depression at base and slightly broader than the lower, with the scrobes lateral and the inferior basal furrow absent ; antennae with the scape just reaching anterior

margin of the eye and with the 2 basal funicular joints subequal or 2 very slightly longer than 1 ; prothorax medially slightly broader than long, about as broad apically as basally, sides moderately rounded and the ocular lobes moderately developed, with the upper surface slightly convex, closely set with small bare tubercles, each slightly flattened apically and with a minute seta, with an indication of a central furrow without any carina and with 3 ill-defined rows (sometimes absent) of small white scales ; elytra elongate, subelliptical in ♂ and oblongo-ovate in ♀, shoulders rounded, sides slightly rounded, more so in ♀, broadest at about middle, apical processes absent, with the upper surface convex, with regular rows of punctures, giving it a subreticulate or foveate appearance ; intervals with regular rows of small shining granules, each bearing a depressed pale seta, with the interstices (especially towards the apex) covered with very sparse small white scales (sometimes absent) and more or less distributed laterally as whitish spots ; legs rather short, plump, with very sparse fine white hair-like scaling ; anterior and intermediate tibiae minutely dentate on their under surfaces ; posterior tarsi more developed in ♂, with joint 3 the broadest and 1 broader and longer than 2, and 2 longer than 3. ♂ smaller than ♀.

From five specimens.

Length (excl. head and rostrum), 10–13½ mm.

Breadth, 3½–5½ mm.

Hab.—Cape Colony—Houwhoek, Caledon (R. Lightfoot).

Gordon's Bay (Dr. Andreae).

Allied to *capicola* Ghl., which closely resembles it but differs in having a longer and narrower rostrum, erect black setae on the elytra, unusually elongate first tarsal joints, etc.

H. solitarius sp. nov. Type S.A.M.

(Pl. XVII, fig. 4.)

Head convex, with small punctures and white scales, forehead with a central stria, anteocular furrows faint ; rostrum not incised at base, about as long as the head and prothorax, gently curved, with the upper surface convex in basal half and broadly excavate near apex, distinctly punctured and covered with white scales, with a broad, smooth, slightly raised central line, with the lateral sulci not meeting at base, the upper ones being broader and convergent basally, separated by a narrow carina and filled with white scales, with the scrobes running beneath base of rostrum and with the inferior basal furrow shallow ; antennae covered with white scales, with the scape not reaching the eye, with the basal joints of funicle subequal or 1 slightly longer than 2 and with the club dark brown ; prothorax medially slightly broader than long, broader basally than apically, feebly transversely

constricted apically, with the sides slightly rounded, posteriorly truncate and apically bisinuate, with the ocular lobes well developed, with the upper surface slightly convex, with distant rounded tubercles, which are slightly flattened and arranged more or less in four longitudinal rows on each side of a central furrow containing a distinct carina, with the apices of the tubercles bare and with short depressed setae, and the interstices densely covered with large white scales; elytra quadrangular up to the declivity, with the sides more or less straight, posteriorly acuminate and the apical processes sharp, declivity steep, shoulders rounded, with the upper surface convex and with regular rows of punctures; interval 1 with a row of granules bearing pale depressed setae; intervals 2, 4, and 6 devoid of tubercles; interval 3 with 3 or 4 large rounded tubercles at the base, then with a row of smaller tubercles (sometimes irregular) to beyond middle where they become larger and more conical, the largest being at the summit of the declivity and continued to the apex as 1 or 2 distant tubercles; interval 5 with 4 large rounded boss-like tubercles at the base, then with a row of 3 or 4 small tubercles (sometimes irregular) to beyond middle ending in 2 to 4 larger conical tubercles; interval 7 with a complete row of closely-set conical tubercles; interstices densely covered with white scales except for the space between the large basal tubercles and a space just before the declivity between row 3 and 5 on each side covered with darker more blackish brown scales; legs with dense white scaling and white setae; posterior tarsi with the 3 basal joints of about the same width, 2 slightly longer than 3 and 1 longer than 2.

From four specimens (3 ♂♂ and 1 ♀). ♀ slightly longer, broader, with the apical processes more divergent.

Length (excl. head and rostrum), 15½–19 mm.

Breadth, 7–8 mm. Length of apical processes, 1¼–1½ mm.

Hab.—Namaqualand—Port Nolloth (C. L. Biden).

This species resembles *H. nestor* Mshl. The second interval is, however, entirely devoid of tubercles, the third and fifth each has 3 or 4 boss-like tubercles, more or less of the same size at the base, and not a single large one on 5 as in *nestor*.

H. truncus sp. nov.

(Pl. XVII, fig. 5.)

Black; head convex, sparsely punctured, forehead punctured, with a distinct central furrow and with the anteocular furrows distinct; rostrum separated from head by a deep dorsal incision, shorter than the head and prothorax together, thick, strongly curved, and slightly dilated at the apex, with the upper surface slightly convex, rugosely punctured between the carinae, with 5 strong carinae ceasing apically at the level of the antennal

insertions, the outer ones being distinctly punctured, with the lateral sulci of unequal length, the longer upper ones meeting at the base, with the scrobes deep, lateral and oblique, and the inferior basal furrow very deep; antennae with the scape clavate, just reaching or barely touching the eye, and joint 1 and 2 of the funicle subequal; prothorax transverse, about as broad apically as long, the apical part very slightly broader than base, the sides rounded, broadest about middle, dorsal apical margin distinctly truncate and the ocular lobes moderate, with the upper surface feebly convex, slightly transversely impressed anteriorly, closely set with small rounded, granular, shining tubercles, each with a short depressed pale seta, leaving a narrow central furrow, deeper basally, containing a faint narrow carina abbreviated apically and basally, with an indication basally of three narrow pale lines above and one on each side laterally; elytra ovate, not much broader across shoulders than the prothorax, shoulders roundly prominent, sides subparallel from shoulders to middle, gradually conjointly rounded apically and without apical processes, with the upper surface convex, sulcate, the sulci with rows of shallow punctures, each with a pale seta projecting backwardly over it, and row 1 and 2 to beyond the middle more or less regularly shallowly foveate owing to raised transverse lines, with the intervals more or less evenly raised, subcostate, and with regular rows of small shining tubercles, each with a pale brown depressed seta, which is longer beyond middle on the declivity; intervals 1, 2, and 3 with the tubercles flat, small, and catenulate to beyond the middle where they are longer and more distant; intervals 8 and 9 on the inflexed margins with only a few inconspicuous and distant tubercles; stria 6 on each side with a few flat white scales basally; legs piceous, with pale pubescence; anterior tibiae with long dark setae below and near the apex; posterior tarsi with joint 1 longer than 2, and 2 very slightly longer than 3.

From a single ♂.

Length (excl. head and rostrum), 10 mm.

Breadth, 4 mm.

Hab.—Cape Colony—Palmiet River (Dr. Andreae).

Type in the private collection of Dr. Andreae of Cape Town.

This species is a comparatively small species belonging to the ***capensis*** L., ***impressicollis*** Mshl., and *granulosus* Thb. group.

H. vastivagus sp. nov.

(Pl. XVII, fig. 6.)

Black; head convex, punctured and densely covered with large yellowish white scales, forehead slightly impressed, medially shallowly foveate, densely covered with yellowish white scales, anteocular furrows distinct;

rostrum about as long as prothorax, stout, not incised at base, slightly curved and dilated at apex, with the upper surface angularly and almost perpendicularly declivous at the base, with its sides parallel, with a broad central furrow, deeper apically, rugosely punctured and covered with large white scales, containing a punctured central carina, the raised edges of the furrow undulating and punctured, the lateral sulci subequal, the upper broader ones meeting at the base, the scrobes deep, oblique, directed to under base of rostrum, and the inferior basal furrow deep; antennae short, covered with setiform scales and pale setae, the scape not reaching the eye, joints 1 and 2 of the funicle subequal; prothorax only very slightly broader than long, the base as broad as the apex, sides rounded, broadest at middle, the anterior margin distinctly arcuate and the ocular lobes moderate, with the upper surface convex, closely set with conical, subspiniform tubercles, each with a pale depressed seta, leaving a broad central furrow containing a distinct central carina, abbreviated anteriorly and posteriorly, with the interstices densely covered with large yellowish white scales; elytra ovate, shoulders sloping, sides gently rounded, broadest before middle, and the apical processes short, blunt, with the upper surface convex, with regular rows of shallow punctures, not separated by granules, with the intervals convex, with regular rows of small tubercles, each bearing a pale depressed seta; interval 1 with only a small shining tuberculate callus at the base; interval 2 with a complete row of small tubercles, those at the summit of the declivity being larger, more conical, and more distant; intervals 3, 4, and 5 with 2 or 3 basal subspiniform tubercles, the rest small, those on the declivity on interval 3 being larger, more distant, and more conical, and those on interval 4 ceasing before the declivity; intervals 6, 7, 8, 9, and 10 with broader, flatter cycloid scales on the tubercles, becoming more cycloid from 6 to 10, interval 6 with only a few small distant tubercles, 7 with a complete row of small ones, 8, 9, and 10 with small rounded, shining, glabrous tubercles, and intervals 9 and 10 being more convex apically near the apical processes; interstices densely covered with yellowish white scales basally, laterally, along the suture and apically; under surface with large flat whitish and setiform scales; legs with dense dirty yellowish white scaling; tibiae with pale setae; tarsi setiferous, not spongy, posterior ones with joints of the same width, 1 longer than 2, and 2 and 3 subequal.

From a single ♀.

Length (excl. head and rostrum), 15 mm.

Breadth, 7 mm.

Hab.—South-West Africa (Great Namaqualand)—Lüderitzbucht (Dr. Andreae).

Type in the private collection of Dr. Andreae, Cape Town.

This species closely resembles *squalidus* Ghl. and is probably its South-West African representative, differing principally in the rostrum, the dorsal area of which is abruptly and perpendicularly declivous at the base, lacking the very deep median furrow of *squalidus* and having a low median carina.

Gen. SOLENORRHINUS Schoen.

Solenorrhinus Schoenherr, Disp. Meth., p. 257, 1826.
„ Lacordaire, Hist. Nat. Insect. Coleop., vi, p. 369, 1863.

S. granulosus sp. nov. Type S.A.M.

Black, with fine white opalescent scaling; head convex, finely, rugosely punctured, covered with scattered pale scaling, forehead with a feeble fovea, rugosely punctured; rostrum about as long as head and prothorax together, comparatively slender, gently curved, only very slightly dilated at apex, very slightly narrower at middle than base, with the upper surface slightly convex, the basal part slightly raised above forehead and densely rugosely punctured, the apical part just before middle more or less shining and finely punctured, with a distinct shallow central furrow extending from slightly before the middle to apex, with a short elongate fovea on each side of the central furrow on the apex, the lateral sulci subequal, the upper indistinct rugosely punctured ones converging at base, and separated from the more distinct lower ones by a distinct smooth carina, with the scrobes smooth, deep, entirely lateral, extending to base above the anterior margin of eyes, with a short shallow furrow on each side on the under surface extending from antennal insertions to the apex; antennae slender, ferruginous, with very fine white setiform scaling and dark setae, scape slender, shining, markedly clavate, reaching the eyes, joints 1 and 2 of the funicle elongate, and 2 distinctly longer than 1, 3 and 4 subequal, slightly longer than each of the equal joints 5, 6, and 7; prothorax broader than long, about as broad basally as long, narrower apically than basally, the apical and basal margins truncate, the sides greatly rounded, broadest at about middle, with the ocular lobes feeble, with the upper surface convex, closely set with small flat, rounded, granular, shining tubercles, each with a pale depressed seta, leaving an indistinct narrow central furrow, with the interstices covered with whitish opalescent scales, and with three distinct dorsal and two inferior-lateral stripes of white (pinkish opalescent) scales; elytra elliptical, ovate, slightly narrower basally than the prothorax, basal margin truncate, shoulders rounded, not prominent, sides gently rounded, broadest well in front of middle, posteriorly gradually attenuated, with the apical processes blunt, feebly developed, with the upper surface convex, with regular rows of punctures, each puncture with a flat depressed scale

over it; intervals 1, 3, 5, and 7 more convex, more or less costate, with regular rows of closely-set small rounded, shining, granular tubercles, each with a pale depressed seta; intervals 2, 4, and 6 with only a few small distant tubercles, often ceasing beyond middle; interval 8 with a more or less complete row of small indistinct distant tubercles; interval 9 more convex apically where there is a row of minute shining granules; interstices more or less uniformly covered with white opalescent scales having a pinkish sheen; under surface rugulose, scabrous, more or less shining, and with white setiform scaling; intercoxal part of abdomen about as wide as a hind coxa; legs dark piceous, densely covered with white setiform scaling; femora clavate, unarmed, more or less shining, coarsely punctured basally and apically; tibiae rugosely punctured, with long dark setae below, and a row of small denticulations, more feebly developed on posterior pair; tarsi yellowish, spongy below posterior; tarsi with joint 1 about as long as subequal joints 2 and 3 together, broader than 2, slightly narrower than 3.

From two specimens.

Length (head excl.), 9½–10 mm.

Breadth, 4 mm.

Hab.—Cape Colony—Malmesbury (Lightfoot), Matroosberg, Ceres (M. Exp.).

S. proteaphilus sp. nov. Type S.A.M.

(Pl. XVII, fig 7.)

Black, with white, sometimes pinkish, opalescent scaling; head convex, finely rugulose on vertex, and covered with whitish or pink setiform scaling, forehead medially, foveately depressed, coarsely, rugosely punctured, with scattered, flat, whitish or pinkish scales in the fovea and setiform scales laterally; rostrum about as long as head and prothorax together, gently curved, about as broad basally as space between eyes, then very slightly narrowed to middle, thence broadening gradually to the slightly dilated apex, with the upper surface slightly convex, slightly raised basally above the forehead, rugosely punctured to level of antennal insertions, then more sparsely punctured to the more or less shining apex, with a narrow, central, punctured furrow, extending from fovea on forehead to beyond antennal insertions or to the apex, the raised borders of the furrow being rugosely punctured to just before antennal insertions, and from there more or less smooth, with a fairly deep punctured furrow on each side of the central one from the antennal insertions to the apex, the lateral sulci of unequal length, the upper ones meeting at base, separated from the lower by a distinct, smooth or sparsely punctured carina, with fine white setiform scaling on the basal ½, in the central furrow and sulci, with the

scrobes deep, smooth, and lateral, with two furrows on each side on the under surface near the apex, an upper extending from antennal insertions to apex, and a slightly longer lower one; antennae dark piceous, shining, with fine, pale setiform scaling, and dark setae, scape clavate, not reaching or barely touching the eye, joints 1 and 2 of the funicle elongate, subequal, joints 3 and 4 subequal and slightly longer than the equal joints 5, 6, and 7, the club dark velvety-brown; prothorax broader than long, about as broad basally as long, slightly narrowed apically, apex narrower than base, apical and basal margins truncate, sides greatly rounded, broadest just behind middle, ocular lobes feeble, with the upper surface convex, closely set with rounded, shining, granular tubercles, each bearing a pale depressed seta, leaving a central furrow containing a smooth, broad, flattened, somewhat undulating carina, abbreviated apically and basally, with the interstices densely covered with yellowish white scales, and 7 longitudinal bands of whitish or pinkish opalescent scales, 3 dorsally and 2 on each side inferiorlaterally; elytra oblongo-ovate, much broader basally than prothorax, basal margin truncate, shoulders rounded, very prominent, sides gently rounded, broadest at middle, posteriorly suddenly attenuated, and ending in two short, blunt, apical processes, with the upper surface convex, sulcate, the sulci with regular rows of small punctures, separated by minute granules, each bearing a small depressed seta, the 10 intervals convex, more or less costate, with regular rows of small tubercles, each bearing a pale depressed seta; interval 7 slightly more convex than the others, and together with interval 9 forming a basal humeral multituberculate callus; interval 10 convex basally, then obsolete and obscure along the sinuate margin of elytra, becoming faintly visible near the apex; interstices covered with whitish or pinkish opalescent scales which may be more concentrated as stripes along striae 1, 4, 6, and 9 and the apex, and with often a distinct lighter spot at the summit of the declivity on interval 3; under surface punctured, with flat whitish or pinkish and also setiform scales, with some coarse scattered punctures on each segment, especially the apical one, each bearing a long, pale seta; intercoxal part of abdomen slightly narrower than the length of a hind coxa; legs with dense, white, setiform scaling; femora clavate, unarmed, coarsely punctured basally and apically; tibiae rugosely punctured, covered with dark setae, with a row of small dentate spines on their under surfaces, which are feebly developed on posterior pair; tarsi setiferous and punctured above, yellowish spongy below, posterior pair with joint 1 the broadest, cordiform, slightly longer than 2, 2 and 3 subequal in length, and 3 slightly broader than 2.

From four specimens.

Length (head excl.), 14–16 mm.

Breadth, $5\frac{3}{4}$–7 mm.

Hab.—Cape Colony—Cape Town (J. Drury).
French Hoek (Phillips).
Caledon, 4000 ft. alt. (M. Exp.).
Tulbagh, 4000–5000 ft. alt. (M. Exp.).

This large species resembles a *Hipporrhinus*, but its narrow and slender rostrum at once distinguishes it from that genus. It probably feeds on *Proteaceae*. Mr. J. Drury obtained one from the silver trees *Leucadendron argenteum* on Signal Hill, Cape Town.

The three species may be distinguished as follows :—

A (B) Prothorax closely set with small rounded, shining, granular tubercles.

1 (2) Prothorax with a central furrow without a carina ; joint 2 of the funicle distinctly longer than 1 ; under surface of rostrum laterally with a short furrow on each side near apex.

S. granulosus sp. nov.

2 (1) Prothorax with a central furrow, containing a broad flattened carina ; joints 1 and 2 of funicle subequal ; under surface of rostrum with 2 furrows on each side near apex, a short lateral one, and a longer one below.

S. proteaphilus sp. nov.

B (A) Prothorax with spiniform tubercles on the disk and small rounded, shining, glabrous tubercles laterally. With a broad central furrow, containing no carina ; joints 1 and 2 of funicle subequal ; under surface of rostrum laterally with a short furrow on each side near apex.

S. porifer Sparrm.

Gen. ORIGENES Mshl.

1904. Marshall, P.Z.S. Lond., i, p. 141.

O. pulcher sp. nov. Type S.A.M.

(Pl. XVII, fig. 8.)

Head convex, covered laterally with brown scales and white hair-like scales and centrally with dense white scales, continuous with those on forehead and rostrum, forehead sloping, slightly excavate, with a narrow, central furrow and with a broad, central band of white scaling, with a row of long, dark, bristle-like setae and seta-like white scales on the upper, elevated, ocular ridges and antero-lateral margins of vertex ; rostrum not incised at base, as long as head and pronotum, curved, strongly dilated

apically, with the upper surface convex, with a narrow furrow, continuous with that on the forehead and extending forwards to the level of the antennal insertions, with the apex plane, rugosely punctured and covered with dense, white scaling, and with a row of long, dark, bristle-like setae and white setiform scales on each side of furrow, the apex covered with fine, white, hair-like scaling and dark setae laterally and ventrally, with the lateral sulci distinct, the upper ones uniting at base and bounded posteriorly on each side by an oblique ridge, with the scrobes lateral and the inferior basal furrow absent; antennae with fine, white, hair-like scaling, with the scape not reaching the anterior margin of eye and the two basal joints of funicle equal in length; prothorax broader than long, sides slightly rounded, broadest before middle, about as broad apically as basally, ocular lobes well developed, with the upper surface slightly convex, closely set with small granules, the apices of which are bare, each with a bristle-like, dark, semi-erect seta, leaving a broad, central furrow, containing a faint, narrow carina, and a longitudinal, lateral space on each side free from granules, with the granules bordering the central furrow cristate and longly, darkly setiferous, with dense white scaling in the central furrow and whitish or pale ochraceous scaling on the lateral spaces on each side, extending from the ocular lobes, with dense, brown scaling in the interstices above and dense, pale scaling on the under surfaces; elytra subelliptical to oblongo-ovate, shoulders sloping, rounded, sides slightly rounded, broadest before or at about the middle, apical processes small, with the upper surface convex, sulcated and with regular rows of punctures; intervals slightly costate, 2, 3, 5, and 7 more so, with regular rows of rounded granules, their apices bare and shining, and each with a pale brown seta; interval 1 with a row of granules from about the middle; intervals 2 and 3 more or less cristate and velvety-black near the base and with long dark setae; intervals 3, 5, and 7 with more or less duplicated rows, with the base of 5 very cristate bearing long, dark setae, and a conical mass of agglomerated granules bearing long, pale setae at the summit of declivity on intervals 3 and 5 (the mass on 5 being in front of 3); intervals 4 and 6 with the granules more distant and often entirely absent before middle; interstices with dense, brown scaling (slaty grey in one specimen), with a broad sutural band, becoming narrower towards apex and often ceasing beyond middle, of white to pale ochraceous scaling, scaling of the conical masses and their oblique connection white to pale ochraceous, an oblique, subtriangular patch at about middle extending from interval 2 to 4 velvety-black; under surfaces and inflexed margins of elytra with white scaling; metasternum and abdomen coarsely punctured, the latter with white scaling mainly along the sides; legs with dense, white setae and scales, with a denser, white oblique, subapical annulation on the femora; tibiae very densely

covered with long, white and dark hair-like setae; posterior tarsi with the three basal joints of about equal width, joint 3 the shortest, 1 longer than 2.

From seven specimens of which four cotypes are in the late Dr. Péringuey's private collection (now in the Transvaal University College, Pretoria).

Length from apex of prothorax to apex of elytra, 5½–12 mm. (Type 10 mm.)

Breadth, 2⅓–5½ mm. (Type 5 mm.)

Hab.—Cape Colony—Triangle, Touws River (Dr. Purcell).

Gen. EPICHTHONIUS Schoen.

1826. Schoenherr, Disp. Meth., p. 200.

E. rastricollis sp. nov. Type S.A.M.

(Pl. XVII, fig. 10.)

Oblongo-ovate, ferruginous; head broad, dark ferruginous, rugosely punctured, with pale depressed setae, forehead plane, sloping, more densely covered with pale, depressed setae, with a central, foveate impression between the eyes; eyes prominent, rotundate, brown; rostrum well developed, slightly longer and narrower than head, straight, apically slightly dilated and with longish, pale setae, with the upper surface slightly convex, longitudinally rugose, rugosely punctured, with an obsolete, undulating, medial carina, ending anteriorly in a smooth, shining, foveate impression; antennae setose, with the scape very clavate, just reaching the anterior margin of the eyes, with the funicular joints apically clavate, joint 1 slightly longer than 2 and 2 longer than 3, with the club oblongo-ovate, strongly acuminate, yellowishly, sericeously pubescent; prothorax broader than long, apically, broadly sinuate and constricted intramarginally, with the apical margin elevated, more or less reflected upwards and overhanging the head, with the lateral lobes prominent, rounded, with the sides slightly rounded, posteriorly slightly narrowed, with the base subtruncate, with the upper surface slightly convex, rugosely punctured, covered with long, upright, spiniform tubercles, each with a pale, depressed seta, with a dendritiform, agglomerated mass of tubercles on each side at about the middle (resembling the antlers of a stag, consisting of a central rachis with rami); elytra oblongo-ovate, about 3¼ times as long as prothorax, the shoulders sloping, rounded, the sides slightly rounded, broadest at about the middle, with the apex attenuated, conjointly rounded, with the upper surface convex, irregularly punctured; intervals with rows of tubercles or granules; intervals 3, 5, and 7 with large, rounded tubercles, each with a crown of pale yellow setae and a single, larger, depressed seta,

the basal tubercles of 3 and 5 being confluent more or less costate ; intervals 1 and 6 with distant, setiferous granules ; intervals 2 and 4 with minute, distant, setiferous granules ; inflexed margins irregularly punctured, with rows of obsolete, setiferous granules, the two outermost rows becoming costate apically where the inner one joins interval 3 ; under surface densely punctured, with pale setae ; legs with pale setae ; femora markedly clavate ; tarsi with a yellowish, sericeous pubescence below, posterior ones with joint 1 longer than 2, and 2 and 3 subequal.

From a single specimen.

Length (excl. head and rostrum), 8 mm.

Breadth, 4 mm.

Hab.—Cape Colony—Mossel Bay.

This species resembles *coronatus* Boh., but differs by the presence of lateral dendritiform or "antler-like" structures on the prothorax.

Sub-fam. **Balanininae.**

Gen. BALANINUS Germ.

Balaninus Germar, Mag. Ent., iv, p. 291, 1817.
„ Lacordaire, Hist. Nat. Insect. Coleop., vi, p. 574, 1863.

B. transvaalensis sp. nov. Type S.A.M.

Colour ferruginous brown, scaling on prothorax discally with coppery reflection, with a central, yellowish white stripe, which is broader basally, becoming fainter apically, with the prosternal part and the sides yellowish white, scaling on elytra deep castaneous, apically with a coppery reflection, basally with a broad, transverse, creamy or yellowish white band.

Head globose, closely punctured, with fawn-coloured scaling above, and the antero-lateral borders of eyes with yellowish white scaling ; eyes large in ♂ ; rostrum elongate, moderately stout, subporrect to about middle, thence curved to apex, rufo-testaceous, bare, an obscure spot above antennal insertions and mandibles black, with the upper surface in ♂ strigoso-punctate in basal ½, apical half shining and finely punctured, medially subcarinate to about the middle ; antennae comparatively short, testaceous, inserted slightly beyond middle in ♂, with fine, white, setiform scaling on funicle, with joints 1, 2, and 3 of funicle more elongate, 1 longer than 2 and 2 longer than 3, the terminal joints short, scarcely longer than broad, the club ovate, dark fuscous, with joints 1 and 2 transverse, and 2 quadrate ; prothorax broader than long, narrower apically than basally, constricted apically, the apical margin truncate, and the basal one subtruncate, the sides strongly rounded, broadest just behind middle, with the upper surface finely, reticulately punctuated, without any carina, covered with dark

chestnut-brown, cuprescent scaling on the disk, leaving a central stripe wider basally and faint apically of yellowish white scales, the sides laterally, except for a round brownish spot at about middle, as well as the prosternal parts, densely covered with yellowish white or white scaling; elytra ovate, subtriangular, broadest at the roundly prominent shoulders, sides very slightly rounded, narrowed and attenuated to the apex, with the upper surface convex beyond middle, basally more or less plane, with the striae fine, distinctly punctured, the intervals plane and coriaceous, and the suture slightly convex beyond middle, with moderately dense scaling, deep castaneous beyond middle, distinctly cuprescent apically beyond middle from interval 1 to 6, with a broad, transverse, basal band and the scutellum covered with creamy-white scales, obscurely mottled with fawn-coloured spots, with some fawn-coloured scales along the suture, the apical margins, and on some scattered, obscure spots laterally; pygidium exposed, reticulately punctuated, with dense, fawn-coloured or yellowish setiform or brush-like scaling; under surface with dense, cream-white scaling, denser and whiter on the mesosternal epimera, the apices of the metasternal episterna and the apical margins of the abdominal segments; legs testaceous, with fairly dense, yellowish white scaling; femora clavate, armed with a stout, simple tooth; tibiae slightly dentately dilated subbasally below, distinctly uncinate apically.

From two ♂ specimens.

Length (head excl.), 4½–5 mm. Length of rostrum, 2–2⅓ mm.

Breadth, 2–2⅓ mm.

Hab.—Transvaal—Johannesburg.

This species belongs to the *nubifer* Mshl. and *ficorum* Mshl. group with the tibae uncinate and joint 2 of the club transverse. It is nearer *ficorum*, for joint 7 of the funicle is subequal to 6, is broader and not appressed to club. It is, however, differently coloured, and with a more subtriangular hind body.

B. valens sp. nov. Type S.A.M.

Colour ferruginous brown, with the upper surface covered with brownish and white scaling, with three lines on the prothorax and some irregular, transverse markings on the elytra whitish, with the under surface densely covered with yellowish, yellowish brown and white scaling.

Head globose, finely and closely reticulately punctured, with sparse, yellowish scaling laterally, forehead with a central foveole and sparse, fine, whitish or yellowish, setiform scaling; eyes large, black; rostrum elongate, moderately stout, much longer than the body in ♀, dark ferruginous up to the antennal insertions, thence paler, more testaceous, shining beyond antennal insertions, mandibles black, the basal ⅔ subporrect, thence curved

to apex, with the upper surface in ♀ strigoso-punctate basally about half-way to the antennal insertions, where there is also a shallow, coarsely punctured furrow on each side above the scrobes, thence evenly punctured to apex, where the punctures become finer, leaving only a central, smooth, impunctate line on subporrect part, which becomes carinate basally; antennae inserted at about $\frac{1}{4}$ of the length of the rostrum near base in ♀, dark ferruginous, the scape more rufo-testaceous, slender, reaching the eye, the funicle covered with tawny scaling, with joints 1 and 2 elongate, 1 about as long as 2 and 3 together, 2 longer than 3, joints 3, 4, and 5 subequal, each slightly longer than 7, 6 the shortest, 7 the broadest, not appressed to club, the club whitishly pubescent, with joints 1 and 2 transverse, and 2 quadrate; prothorax broader than long, narrower apically than basally, constricted apically, the dorsal, apical margin truncate, and the basal one bisinuate, the sides rounded, broadest behind middle, strongly narrowed anteriorly, with the upper surface very convex, closely reticulately punctured, with a central, flattened carina, becoming finer and indistinct apically, covered with moderately dense, brownish scaling (abraded discally), with more or less three lines of whitish scales, the lateral ones being broader, the pleurae with denser, whitish and yellowish scaling, and often with a denser, whitish spot at about the middle; scutellum comparatively large, tubercularly raised, more or less quadrate, sulcate centrally, and bifid basally; elytra ovate, cordiform, with the basal margin trisinuate, broadest at the shoulders, which are roundly prominent, sides scarcely rounded and rapidly narrowed to apex, with the upper surface convex, distinctly depressed in the circumscutellar region, the striae fine and distinctly punctured, striae 5 and 6 being curved inwards at the base, and 7 ceasing basally behind the shoulders, the intervals broad, plane, densely covered with brown and whitish scales, the white scales being more or less transversely arranged across the intervals as irregular bands; pygidium visible, with dense, yellowish white setae; under surface with dense, white and yellowish scaling, with a central, longitudinal depression, extending across mesosternum to segment 2 of the abdomen; legs rufo-testaceous, the apical parts of the femora blackish across the clavate part; femora markedly and abruptly clavate apically, with a triangular, dentate, subapical tooth below, slightly larger on the posterior ones, covered with moderately dense, fine, white and yellowish scales; tibiae distinctly uncinate, the anterior ones being distinctly curved inwards near the base, the dorsal margin being thus slightly sinuate, covered with finer, separated, white, setiform scales; tarsi with joint 3 broadly bilobate and yellowishly spongy below.

From two ♀♀.

Length (head excl.), 6–6$\frac{1}{5}$ mm. Length of rostrum about 9–9$\frac{1}{3}$ mm.

Breadth, 3$\frac{1}{2}$–3$\frac{2}{3}$ mm.

Hab.—Transvaal—Trichardt (M. Gould). (Type from here.)
Natal—Krantzkop (M. Exp.).

This species seems to be near *nubifer* Mshl., but differs in its much longer rostrum and the presence of a carina on the prothorax.

Sub-fam. **Ambatinae.**

Gen. PHACEMASTIX Schoen.

Phacemastix Schoenherr, Mant. sec. Curc., p. 72, 1847.

P. kaokoensis sp. nov. Type S.A.M.

Dull black, with numerous large, white spots; under surface with uniform, dense, white scaling,* except on the three apical segments of the abdomen, which are sparsely scaled, with three irregular, black spots (the smallest at the apex) or are traversed more or less longitudinally by a black fascia on each side; head subconical, closely and coarsely punctured, black, with a large subquadrate patch of white scales below each eye and a fainter, central streak on the vertex, continuous anteriorly between the eyes with scales on the base of rostrum; eyes closely approximated, but not contiguous; rostrum about as long as prothorax, distinctly curved, broadest at base and gradually narrowed to beyond middle, thence slightly widening to apex, apical part flattened, smooth, shining, and with fine, scattered punctuation, leaving a rather broad, impunctate line between the antennae at about the middle, with the basal part compressed dorsally, strigosely punctured laterally and covered with dense, white scales, medially with a shiny ridge ascending the forehead between the eyes; antennae reddish black, with white scales, with joint 2 of the funicle distinctly longer and narrower than 1, with the club large, ovate, dull black and about as long as the last 5 joints of funicle; prothorax slightly broader than long, broadest at base, sides almost straight and gradually converging to near the apex, which is markedly constricted, with the apical margin truncate and the base bisinuate, with the upper surface almost plane, rugosely and evenly punctured, with an indication (especially anteriorly) of a central, smooth line in some specimens, dull black above, with three lateral, large,

* The seven specimens from the Kaokoveld are uniform in their scaling and colour, but the three specimens from Zululand differ in the following respects: the under surface is not uniformly white; the prosternal part with a large antero-lateral spot, and another opposite the coxae with yellowish scaling; the mesosternal epimera, the metasternal episterna, the lateral spot on the meso- and metasterna, the apical margin of segment 2 on the abdomen, as well as a spot laterally on each side of segments 3 and 4 with yellow scaling; the rest of the under surface and legs with sparse white scaling. I consider these differences as only varietal.

white spots in a row on each side, a small infero-lateral spot opposite the large middle one on each side, a small elongated antero-dorsal one and two small, transverse, medial, discal ones, and with dense white scaling below; elytra broadest at shoulders which are rotundately prominent, gradually narrowed to apex, with the upper surface plane, shallowly depressed in the scutellar region, with broad striae, containing deep punctures, with the intervals plane and rugose, dull black, with numerous, irregular, white spots, with a large, quadrate one basally near the scutellum, a large transverse one extending across the subapical callus to the margin and a medial subapical elongate one on the suture; legs black, with dense white scaling; femora triangularly dentate, posterior ones with a black spot subapically; tibiae mucronate, with the apices black; tarsi with joint 3 black.

From ten specimens.

Length, 6–7 mm.

Breadth, $2\frac{1}{2}$-3 mm.

Hab.—South-West Africa (Kaokoveld)—Kaross, and at Cayimaeis on the Hoanib River, South Kaokoveld. (Type specimen and 1 cotype).

Zululand—Mfongosi (Jones).

This species is closely related to if not a variety of *pardalis* Mshl. It is distinguished from the latter by its smaller size, more slender form, by joint 2 of the funicle being distinctly longer than 1, the club smaller and shorter, the prothorax being less rounded laterally, the apex of the elytra not being white but with fairly constant white markings and the legs being much more slender.

P. picta sp. nov. Type S.A.M.

Black, with white scaling and the following cadmium yellow, orange or reddish yellow markings: the antero-lateral parts on the prothorax, a longitudinal fascia on each side of the suture, extending from base to beyond middle, a subapical fascia along the suture, a central, mesosternal spot, a spot on the mesosternal epimera, the metasternal episterna in part, the apical margin on segment 2 of the abdomen, and the lateral parts of segments 3, 4, and 5; with the following black markings: a central band on the prothorax, broader posteriorly, a spot on each side just before middle, a spot on the prosternum, a central, sutural band on the elytra, confluent beyond the middle with a large spot, a fascia on each side of the yellow fascia, extending to about the middle, a subapical spot on each side near apex, and the lateral, inflexed margins from base to beyond middle.

Head subconical, closely punctured, black, with fine white scaling; eyes only slightly approximated above; rostrum much shorter than prothorax, distinctly curved, broadest at base, subparallel or only very slightly narrowed to beyond middle, thence very slightly widening to apex, black, with the upper surface strigoso-punctate to about middle above, and beyond the middle laterally, with the apical part shining, finely punctured, leaving a central, impunctate line, passing basally into a central, shiny ridge ascending the forehead between the eyes, with the basal part slightly compressed dorsally, and covered with fine, white scaling basally and laterally to about middle; antennae ferruginous, the club large, dark fuscous, with a basal ring whitish pubescent, as long as funicle; prothorax slightly broader than long, sides rounded, broadest near base and gradually narrowed to apex, where it is slightly constricted, apical margin feebly sinuate, basal margin slightly bisinuate and with a slight lobe in front of scutellum, with the upper surface almost plane, even slightly depressed basally, finely, rugosely and evenly punctured throughout, except for a central, smooth, shining, flattened, abbreviated carina at about the middle or just before it, black, covered with fine, white, setiform scaling, leaving a central band, very broad basally and narrower apically as well as a round spot on each side just before middle, and another antero-laterally on the prosternum, bare, with the anterior prosternal margin and the antero-lateral parts covered with broader, lanceolate, cadmium yellow, orange or reddish yellow scaling; elytra broadest at the roundly prominent shoulders, thence subparallel to beyond middle, where it is gradually rounded to apex, with the upper surface plane, slightly depressed basally along suture, with fine, deeply punctured striae, with the intervals plane and rugose, black, covered with rather sparse, white scaling, leaving the scutellum, a sutural band, extending to beyond the middle and there confluent with a broad transverse spot on each side from interval 1 to 4, a subapical spot on each side across intervals 2, 3, and 4, a discal fascia along intervals 5 and 6, extending from near base to about middle, and the lateral inflexed margin from base to beyond middle, more or less bare, shining, with sparse black scaling; the following markings, a large basal spot across intervals 2, 3, and 4, sometimes connected posteriorly with another distinct elongate spot just behind middle by a mixture of white and yellowish scales or sparse, orange or reddish scaling, and a short, subapical, sutural fascia on the declivity of dense, lanceolate, cadmium yellow, orange or reddish yellow scaling; under surface closely punctured, with white scaling, with a central, mesosternal spot, a large spot on mesosternal epimera, the apical $\frac{1}{2}$ of metasternal episterna, a basal spot on each side of segment 1 on the abdomen, the apical margin of segment 2, and the lateral parts of segments 3, 4, and 5 of dense, lanceolate, yellow,

orange or reddish yellow scales; legs black, punctured, covered with somewhat sparse white scaling; femora armed with a large, triangular, stout tooth; tibiae with the apices ferruginous and uncinate; tarsi ferruginous, shining.

From seven specimens.

Length (head excl.), $4\frac{1}{3}$–$4\frac{2}{3}$ mm., average $4\frac{1}{2}$ mm.

Breadth, 2 mm.

Hab.—Cape Colony—Kimberley (Bros. Power). (Type and two other specimens.)

Transvaal—Junction of Crocodile and Marico Rivers (R. Tucker).

South-West Africa (Ovamboland)—Namakunde (M. Exp.).

This species is much smaller and quite distinct from *baridioides* Fhs.

Sub-fam. **Cryptorrhynchinae.**

Gen. Ocladius Schoen.

Ocladius Schoenherr, Disp. Meth., p. 316, 1826.

,, Lacordaire, Hist. Nat. Insect. Coleop., viii, p. 80, 1866.

O. bimaculatus sp. nov. Type S.A.M.

Black, sparsely covered with pale setae, and with a humeral spot on each side of dense, creamy-white, setiform scaling. Head convex, finely coriaceous, vertex with fine, scattered punctuations, each with a fine, recumbent, pale scale, forehead coarsely punctured, with sparse, fine, white, setiform, recumbent scales; rostrum curved, about as long as prothorax, with 3 dorsal carinae and 4 deep punctate sulci, each puncture with a very fine, white, upright, setiform scale; antennae ferruginous, with very fine, pale setae, joint 1 of the funicle the longest, longer than 2, 2 and 3 subequal, each longer than 4, 4 slightly longer than 5, 5, 6, and 7 subequal; prothorax subglobular, broader than long, apically slightly arcuate, basally truncate, narrowed apically, slightly constricted, much narrower than base, sides greatly rounded, broadest at about middle, dark piceous, margins of ocular lobes ferruginous, with the upper surface very convex, honeycomb-like, set with large, deep, foveate punctures, each with a long, erect, pale seta, the intervals between the punctures forming irregular, zig-zag, shiny, impunctate, longitudinal carinae, the apical punctures more elongate, foveate, separated by smooth straight carinae; elytra subglobular, longer than broad, basal margin as broad as basal margin of prothorax, shoulders rounded, sides rounded, broadest behind shoulders, broadly rounded apically, with the upper surface very convex, sulcated, the sulci broad, with irregular, shallow punctures, interrupted laterally and discally to about middle by irregular, transverse.

raised septa, giving the basal ½ and inflexed part an appearance of having elongated foveae, with the intervals about as broad as the sulci, plane, coriaceous, with rows of distant, semilunar, shallow pits, whose semilunar, raised margins become more prominent, subtubercular apically on the declivity and also laterally basally on interval 8 to margin as well as on interval 6, each pit with a pale, suberect seta, beyond the basal, raised part intervals 7, 8, and 9 are narrower and more or less smooth, the suture slightly elevated from base to about middle and more or less ferruginous, with a patch of dense, creamy-white, setiform scaling humerally at base of intervals 6 and 7; posterior part of pectoral canal bounded by a visible, arcuate, carinate edge; ventrite 1 with a small, medial, downwardly projecting lobe on the arcuate and carinate, apical margin which overhangs the following ventrite, with a slight sinuation laterally on each side behind posterior coxae, the surface with large punctures arranged more or less arcuately near apex and separated by arcuate rugae, each puncture with a pale seta; apical ventrite densely punctured and setiferous; femora deeply sulcated below, the sulci bounded on each side by a sharp carinate edge, both the inner and outer lateral surfaces each with 3 sulci and 2 carinae, the dorsal surfaces with 3 sulci separated by 4 carinae, the inner upper sulcus being often deeper and not reaching the base, all the sulci with a row of punctures, each with a pale setiform scale; tibiae broadly grooved below, narrowly and deeply sulcated dorsally, the outer more prominent dorsal edge being sharp, subdenticulated on the anterior ones, distinctly denticulated on posterior ones and denticulated and with a distinct angulation near the base on the intermediate ones, all the tibiae with a visible, small, ventral, subapical tooth near the apical mucro, intermediate and posterior tibiae also with a distinct and larger apical dentate spine dorsally, with the inner dorsal edge and inner ventral edge on the posterior tibiae also showing a few small denticulations near apex, with 3 rows of punctures and 2 faint carinae on both the inner and outer lateral surfaces of all the tibiae, with a patch of golden yellow setae near the apex on the outer surface of both the intermediate and posterior tibiae, and with some long, pale setae on the ventral surfaces of all the tibiae near the mucro, the anterior and intermediate tibiae are about equal in length and a little shorter than the posterior ones.

From eight specimens.

Length (excl. head), 4–5 mm.

Breadth, 2½–3 mm.

Hab.—South-West Africa (Kaokoveld)—Hoarusib Otshu, Kamanyab, Kaross (M. Exp.).

This species belongs to the group with a globular prothorax. It can, however, be easily distinguished from the other members of the group by

the deep sulci on the elytra. Like most of the species of *Ocladius*, they resemble the seeds of plants when their legs are drawn up under the body and are thus easily overlooked.

O. rupicolus sp. nov. Type S.A.M.

(Pl. XVII, fig. 11.)

Very dark piceous, with the rostrum, antennae, elytra, and tibiae often more or less dark ferruginous, with a transverse, basal band across elytra of a mixture of white and pale brown scaling and 2 other transverse, sinuated bands on the apical ½ of white scales, bordered apically by pale brown scaling which also extends down the suture to near apex, with often a subapical spot on each side of whitish scales.

Head convex, vertex with fine, scattered punctuations, each with a fine, pale, recumbent seta, forehead more coarsely and deeply punctured, with sparse, pale, setiform scaling, often with a distinct, central, carinate line, continuous with central carina on rostrum; rostrum longer than prothorax, curved, with 3 dorsal carinae and 4 deep punctate sulci, each punctuation with a suberect, fine, white, setiform scale; antennae dark ferruginous, with very fine setae, joint 1 of the funicle the longest, slightly longer than 2, 2 longer than 3, 3 slightly longer than 4, joints 5, 6, and 7 subequal, about as long as broad, and each very slightly shorter than 4, club with very fine, silvery-white pubescence; prothorax subconical broader than long, apically slightly arcuate, basally truncate, sides slightly rounded, broadest just before the base, slightly constricted at apex, with the upper surface convex, dark piceous, set with large, deep punctures that are longitudinally confluent, the intervals between the punctures forming discally distinct, impunctate, undulating or straight shiny carinae, and laterally somewhat irregular wavy, often confluent carinae, with often the central discal 3 more distinct, each puncture with a long, pale, somewhat recurved seta; elytra subglobose, a little longer than broad, base slightly broader than prothorax, sides rounded, broadest at about middle, broadly rounded posteriorly, deep dark piceous to dark reddish, the basal margin dark ferruginous, with the upper surface convex, with regular rows of deep, quadrate foveae, separated by transverse ridges, each with a minute, shining tubercle beyond middle on apical ½ of rows 1, 2, and 3, with a complete row of tubercles on rows 4 to 8, with the foveae on rows 5, 6, and 7 separated by larger, shining, rounded tubercles (the size of the tubercles increases more or less from row 4 to row 6 or 7), with the intervals convex, subcarinate; intervals 1, 3, and 5 broader, slightly more convex, 1 and 3 rugosely punctured on basal ½, with an irregular row of small, shining, rounded tubercles on apical ½, 5 with a complete row of irregular tubercles;

intervals 2, 4, 6, 7, 8, 9, and 10 subcarinate, more or less wavy, 6, 7, 8, and 9 more distinct, 7 traversely rugose, 9 and 3 forming apically a small, subtuberculate callus; suture distinctly prominent from base to beyond middle; interstices with a broad, transverse, basal band, extending from shoulder to shoulder of very pale brown scales, intermixed with white scales, especially more concentrated into spots basally on intervals 3, 5, and 7, with 2 transverse, sinuate bands, one at about middle or just behind it from suture to interval 5 on each side, and the other on the declivity from suture to apex of interval 5 and 6 on each side of white scales, mottled and bordered apically by pale brown scaling which also extends down the suture to about midway down the declivity, as well as a spot of white scales on the subapical callus formed by intervals 3 and 9; pectoral canal not sharply delimited posteriorly; ventrite 1 with the arcuate more or less carinate, apical margin slightly overhanging the following ventrite and often with a distinct, small tubercle on each side near apex, with the surface punctured and setiferous, the punctures often being separated by more or less arcuate rugae; apical ventrite coarsely punctured and setiferous; femora deeply sulcated below and bounded by a sharp, carinate edge on each side, the outer edge being distinctly dentate on the intermediate and posterior femora, both the inner and outer lateral surfaces with 3 sulci and 2 carinae, the dorsal surfaces with 3 sulci and 4 carinae, all the sulci with a row of punctures, each with a pale seta; tibiae grooved ventrally and narrowly sulcated dorsally, the outer, more prominent, dorsal edge being sharp, subdenticulated on intermediate tibiae and distinctly denticulated (especially towards the apex) on posterior tibiae, the ventral sulcus on intermediate tibiae with a row of minute denticulations, more visible apically, a vestige of the ventral, subapical tooth present in front of mucro and often quite a prominent, apical, dentate spine on dorsal surface, with 3 rows of punctures separated by 2 faint carinae on both the inner and outer lateral surfaces, each puncture with a pale seta, with a patch of golden yellow setae near apex on the outer surfaces of the intermediate and posterior tibiae as well as a few long setae apically in front of the mucro, the anterior tibiae slightly longer than the intermediate ones, but shorter than posterior ones.

From thirty-two specimens.

Length (excl. head), 4–4½ mm., average 4 mm.

Breadth, 2½–3 mm.

Hab.—South-West Africa (Damaraland)—Outjo, Tsumeb (M. Exp.), Karibib (Michaelson).

South-West Africa (Kaokoveld)—Kamanyab, Zesfontein (M. Exp.).

This species is very common under stones in North Damaraland and the

Kaokoveld. It is related to *costiger* Boh., from which it may be distinguished by the more or less 3 transverse bands of pale brown scales intermixed with white on the elytra, by the distinct granular nature of intervals 1, 3, and 5, and by the carinae on the prothorax not being so regular, straight, and distinct as in *costiger*.

Sub-fam. **Cossoninae.**

Gen. MESOXENOMORPHUS Woll.

Mesoxenomorphus Wollaston, Tr. Ent. Soc. Lond., p. 451, 1873.

M. luridus sp. nov. Type S.A.M.

Orange ochraceous, shining, the head and rostrum more orange; the junction between head and prothorax and the faint sutural junction reddish. Head convex, more or less smooth, with only a few widely separated, small punctures, the forehead with a few slightly larger, separated punctures laterally; eyes very small, dark, and granular; rostrum longer than head, comparatively broad, stout, porrect to antennal insertions, slightly curved apically, with the upper surface convex, with fine, scattered punctures, denser laterally, the apex and the part around the antennal insertions dark brownish, with a few very fine, golden yellow, slender setae on epistomial region, the scrobes oblique, directed under base of rostrum; antennae with very fine, pale yellowish or white setae, club yellowishly pubescent, the scape reaching posterior lower margin of the eye, the funicle incrassate, joint 1 of funicle broader and longer than the others, slightly longer than 2, joint 2 slightly longer than 3, joints 3, 4, and 5 short, subequal; prothorax longer than broad, slightly attenuated towards apex, with a shallow, apical constriction, with the dorsal, apical margin truncate and slightly narrower than the truncate, basal margin, the sides gently rounded, broadest at about the middle, with the upper surface convex, set with separated, shallow punctures, leaving a smooth, feebly raised, central line; elytra elongate, with the basal margin feebly conjointly sinuate, about as broad basally as the prothorax, the sides slightly rounded, very gradually widening from the shoulders to about the middle, thence narrowed and conjointly rounded apically, with the upper surface convex, roundly declivous posteriorly, the striae faint, with rows of fine, shallow, separated punctures, the intervals broader than the striae, plane, each with a row of very minute, separated punctures, each puncture with a very minute, scarcely visible, pale seta, the setae more distinct apically, the sutural junction faintly reddish, especially apically; under surface with scattered punctures; legs with very fine scattered punctures, the tibiae strongly mucronate, and with fine setae below.

From a single carded specimen.
Length (head excl.), 2½ mm.
Breadth, ¾ mm.
Hab.—Cape Colony—Cape Town (A. Raffray).

Gen. PORTHETES Schoen.

Porthetes Schoenherr, Gen. Curc., iv, p. 1041, 1838.
,, Lacordaire, Hist. Nat. Insect. Coleop., vii, p. 336, 1866.

P. dissimilis sp. nov. Type S.A.M.

Dark piceous to black, more or less shining.

Head convex, with the vertex more or less smooth, with only a few scattered, fine punctures, forehead closely more coarsely punctured, with a central fovea; eyes lateral, ovate, depressed; rostrum piceous to dark piceous, shining, in ♂ about as long as head and prothorax together, broader, stouter, porrect to antennal insertions, thence slightly curved, feebly dilated opposite antennal insertions, thence very gradually narrowed to middle, from where it very gradually widens to apex, subcylindrical, with the upper surface convex, coarsely punctured basally, leaving only a central smooth line, apical ⅔ more or less smooth beyond antennal insertions, with some large and small, separated punctures on the side, more or less arranged in rows, the apex with fine, separated punctures, the scrobes distinct and lateral, in ♀ subporrect throughout or only very feebly curved, shorter, shorter than prothorax, broad basally and dilated opposite antennal insertions, where there is a faint, central, foveate impression, thence abruptly narrowed, being cylindrical and smooth to apex, which is not dilated, with only the upper surface of the basal enlarged part coarsely punctured, the scrobes very short and indistinct; antennae ferruginous to piceous, with pale setae, the apical part of club with pale, golden pubescence, the ♂ with the antennae longer, inserted at about the basal ⅓, the scape longer, curved, broadly and gradually clavate, reaching the posterior margin of the eye, the ♀ with the antennae shorter, inserted at about the basal ⅕ or ⅙, the scape straight, short, and shortly club-shaped, reaching the posterior margin of the eye, joint 1 of the funicle in ♂ and ♀ slightly longer than 2, joint 2 longer than 3, joints 3, 4, 5, 6, and 7 short, more or less subequal, gradually widening apically; prothorax slightly broader than long, longer than broad basally, constricted apically, the constriction visible dorsally, with the dorsal, apical margin truncate and much narrower than the truncate or feebly arcuate, basal margin, the sides rounded, broadest just behind middle, with the upper surface flattened, only slightly convex, slightly, foveately, depressed centrally at the base,

uniformly set with large and small punctures throughout, leaving only a smooth, central, flattened carina in ♂ or subcarinate line in ♀, the pleurae closely and coarsely punctured; scutellum triangular, with a few punctures; elytra elongate, as broad basally as the prothorax in ♂ specimen, very slightly broader than prothorax in ♀♀, with the basal margin slightly conjointly sinuate, the shoulders rectangularly rounded, the sides gradually narrowed behind shoulders to just before middle, thence gradually widened and rounded, being narrowed and broadly, conjointly rounded apically, broadest just behind middle, with the upper surface slightly convex, sulcated, the sulci with regular rows of shallow, separated punctures, with the intervals broader than the sulci, plane, more or less transversely rugose, more so basally in ♂ specimen, each with a row of separated punctures bearing whitish flat depressed setae; under surfaces with scattered punctures, each with a pale seta, finer in ♀, the rows of setae on segments 3 and 4 of the abdomen in the ♂ being larger and flatter; legs piceous to dark piceous, with scattered punctures and pale setae, the setae more slender and finer in ♀; the femora clavate apically, with a distinct subapical, dentate spine below in ♂, more strongly developed on anterior pair, obsolete in ♀; the tibiae subsulcate dorsally, with the dorsal edge carinate, with the apices bidenticulate, armed with a curved mucro and a smaller tooth; the tarsi with joint 3 bilobed, whitishly and sericeously spongy below.

From 1 ♂ and 2 ♀♀.

Length (head excl.), ♂ 6 mm.; ♀ 4¾–5 mm.

Breadth, ♂ 2½ mm.; ♀ 1⅞–2 mm.

Hab.—Cape Colony—Grahamstown (Agric. Dept.) (Dr. C. Mally).
Kentani (Miss Pegler).

This species probably closely resembles *zamiae* Boh., but according to the description of the latter there is no central flattened carina (♂) or carinate line (♀) on the prothorax and the femora are unarmed ("*muticis*" even in the generic description), while in *dissimilis* sp. nov. the femora are provided (especially on the anterior ones of the ♂) with a distinct subapical dentate spine.

Sub-fam. **Erirrhininae.**

Gen. Hypsomus Schoen.

Hypsomus Schoenherr, Gen. Curc., iii, p. 516, 1836.
,, Lacordaire, Hist. Nat. Insect. Coleop., vi, p. 469, 1863.

H. bellulus sp. nov. Type S.A.M.

Pale brownish, the prothorax more castaneous, the head, rostrum, the pleurae on prothorax, an elongate spot beyond middle on each elytron, a

fascia on the lateral inflexed margins, and the under surfaces black, covered with moderately dense, white scaling on head, along 3 longitudinal bands on prothorax, a spot on the black spot on each elytron, and the under surfaces.

Head globose, black, with moderately dense, white, slightly opalescent scaling, forehead with a small foveate impression; rostrum elongate, black, about as long as prothorax, gently curved, comparatively thick, subcylindrical, slightly elevated at base and separated from head by a slight transverse impression, with the upper surface closely punctured and with moderately dense, white scaling in basal ½, more sparsely in apical ½, where rostrum also slopes forwards, being less elevated, without any carinae or sulci, the scrobes directed beneath rostrum; antennae pale, castaneous, the club dark, with the scape not reaching the eye, joint 1 of the funicle thicker and much longer than any of the others, joints 2 to 7 very short, bead-like, subequal; prothorax more or less transverse, about as long as broad, subcylindrical, transversely, slightly constricted near apex, with the apical margin feebly lobate and the basal margin slightly arcuate, the sides very slightly rounded, broadest at about or just behind middle, the base very slightly broader than the apex, the ocular lobes very feeble, with the upper surface convex, castaneous, evenly punctured throughout, each puncture with a very fine pale recumbent seta, with three longitudinal lines of moderately dense, white scaling on the disk and some concentrated white scaling on the pleurae above the coxae, the pleurae black, except for the anterior prosternal margin; scutellum black, minute but distinct; elytra elongate, the basal margin conjointly sinuate and not broader than prothorax, the sides rapidly dilated to form a rounded humeral angle, thence subparallel to beyond middle and gradually narrowed to the conjointly rounded apex, pale brownish, with a large elongate, black spot between stria 1 and 4 just behind the middle, extending forwards along interval 2 and posteriorly along intervals 2 and 3 to summit of declivity, with the inflexed margins black to beyond the middle, leaving only the extreme lateral margin brownish, with the striae with regular rows of distinct small quadrate punctures, with the intervals narrow, feebly convex; interval 1 slightly more convex than the others, more convex apically; interval 3 more convex apically; intervals 4, 5, 6, and 7 together forming a slight, subtuberculiform elevation at the summit of declivity; the intervals with rows of slightly separated white scales, denser on intervals 1, 3, 5, and 7, and with a spot of white scales between stria 2 and 3 on interval 3 beyond middle on the large black mark and another on the subapical elevation; under surface black, with moderately dense, white scaling, denser on mesosternal epimera and the lateral parts of the meso- and metasterna; legs pale brownish, with moderately dense white scaling,

with a subapical annulation of denser white scales on femora; tarsi with joint 1 as broad as but only very slightly longer than 2, 3 the broadest, bilobate, about as long as 1, the claws free.

From a single specimen.

Length (head excl.), $2\frac{1}{3}$ mm.

Breadth, $\frac{4}{5}$ mm.

Hab.—Cape Colony—Cape Town (A. Raffray).

This species is near *parvus* Mshl., but differs from all the other species by its colour and markings.

H. lepidus sp. nov. Type S.A.M.

Pale ferruginous, the prothorax and head darker, the rostrum, antennae, and legs paler, more testaceous, the under surfaces dark piceous, clothed with moderately dense scaling, with three longitudinal lines on the prothorax, a broad, sutural stripe, and the under surfaces with denser greyish white scaling.

Head globose, black, finely punctured, with fairly dense, greyish, contiguous scaling; rostrum slender, as long as or very slightly longer than prothorax, slightly curved, slightly broader basally than forehead, the sides gradually narrowed from base to beyond middle, thence slightly dilated to apex, with the upper surface convex, sparsely covered in basal $\frac{1}{2}$ with small, rounded, flat greyish scales, feebly tricarinate and with 4 shallow sulci, the carinae and sulci becoming faint and ceasing at level of antennal insertions, the sulci with a row of fine punctures, the apical part shining, with a feeble impunctate groove on each side in front of antennae, and with a few scattered, pale setae above and laterally; antennae with very fine, pale setae, the club with pale silvery pubescence, with the scape barely touching the eye, joint 1 of the funicle about as long as next three together, joint 2 longer than 3, with 3, 4, 5, 6, and 7 short, subequal; prothorax about as broad as long, very shallowly constricted apically, with the dorsal apical margin truncate; slightly narrower than the truncate basal margin, whose lateral angles are rounded off, the sides subparallel in basal $\frac{1}{2}$, then suddenly narrowed apically, ocular lobes absent, with the dorsal surface convex, closely and evenly set with fine, reticulate punctures, with moderately dense, small, flat, greyish scaling, with three lines of denser greyish white scaling on the disk and with dense greyish scaling on the under surfaces; scutellum minute and distinctly visible, with greyish scaling; elytra elongate, narrow, conjointly very feebly sinuate basally and not broader than prothorax, the sides rapidly dilated to form a rounded, subprominent, humeral angle, thence subparallel to beyond middle and rapidly narrowed to apex, where each elytron is shortly and separately acuminate, with the upper surface convex, the striae shallow, with regular

rows of distinct punctures, each with a very minute, pale seta, with the intervals plane, broader than the striae, each with a row of minute, pale, depressed setae, more prominent apically, covered with moderately dense, flat, rounded, subcontiguous or slightly overlapping scales; the suture and along interval 1 to near apex and interval 10 as well as the lateral margin with dense, greyish white scaling; intervals 4, 5, 6, 7, 8, and 9 on each side with less dense and paler scaling; intervals 2 and 3 darker, more brownish; under surfaces with moderately dense, greyish scaling, the sternum not impressed in front of fore coxae and the suture between ventrites 3 and 4 (as far as can be seen in carded specimens) distinct throughout; legs with whitish, rounded, flat scaling and scattered pale short setae, the anterior tibiae not angulate internally, the tarsi with joint 4 about $\frac{1}{2}$ as long again as 3.

From two carded specimens.

Length (head excl.), $2\frac{1}{3}$–$2\frac{3}{4}$ mm.

Breadth, $\frac{3}{4}$–1 mm.

Hab.—Cape Colony—Stellenbosch (L. Péringuey).

This species belongs to the *parvus* Mshl. group so far as the structure of its elytra are concerned. It resembles *albosuturalis* Mshl. in colour and markings, but is distinguishable by the shape of its prothorax, which is less rounded, by the presence of a distinct scutellum, by the elytra not having the basal angles strongly produced forwards, and by being separately acuminate apically and by the entire body being narrower and more lanceolate.

H. rugosipennis sp. nov. Type S.A.M.

Dull, dark chocolate-brown, with a line along interval 5 to summit of declivity on each elytron, the under surfaces, and the legs with dull ashy-grey scaling.

Head globose, finely rugosely punctured, forehead more distinctly rugosely punctured, with a ring of ashy-grey scaling round the eyes; rostrum piceous, slender, slightly longer than prothorax, about as long as head and prothorax together, gently curved, cylindrical, slightly narrowed from base to middle, thence slightly dilated to apex, with the upper surface convex, tricarinate, with 4 sulci, the inner sulci shallow, with a row of small punctures and continued beyond middle to apex as a row of small, scattered punctures, the carinae ceasing beyond middle towards apex where surface is sparsely punctured, the outer sulci above scrobes broader than the inner ones and their outer carinate margins continued to apex, thus forming a shallow groove on each side beyond antennal insertions, scrobes lateral, curved; antennae piceous, with the scape not reaching the eye, joints 1 and 2 of the funicle more elongate, 1 broader and slightly

longer than 2, 3 to 7 short, subequal, gradually widening apically; prothorax longer than broad, about as broad basally as long, with the dorsal apical margin feebly sinuate and the basal margin arcuate, very shallowly constricted near apex, the sides rounded, broadest at middle, narrowed apically, the ocular lobes absent, with the upper surface convex, closely and evenly punctured throughout, with a short longitudinal line on each side in basal ½, and the pleurae with small, flat, ashy-grey scaling; scutellum distinct, minute, with ashy-grey scaling; elytra elongate, basal margin conjointly, slightly sinuate and not broader than the prothorax, the sides rapidly dilated to form a rounded humeral angle, thence subparallel to beyond middle and rapidly narrowed to apex, where each elytron is shortly and separately acuminate, with the upper surface convex and very gradually declivous posteriorly, with regular and distinctly punctured striae, with the intervals plane and distinctly transversely rugose, with a band on each side along interval 5, ceasing at summit of declivity, and the lateral margins with dull, flat, ashy-grey scaling, the apex with a clump of short, dark setae; under surfaces with dense, ashy-grey scaling; legs with ashy-grey scaling, the apical ½ of the femora, especially the anterior ones, being more or less scabrous, and the tibiae bluntly mucronate; tarsi very broad, flat, spongy below, joint 1 as broad as and slightly longer than 2, 3 very slightly broader, bilobate.

From a single specimen.

Length (head excl.), 3⅓ mm.

Breadth, 1 mm.

Hab.—Cape Colony—Caledon (Hottentots Holland Mts., 4000 ft.) (M. Exp.).

This species is related to *parvus* Mshl., but is easily distinguished by the different markings, by the carinate rostrum, and the transversely rugose elytra.

Sub-fam. **Rhyparosominae.**

Gen. RHYPAROSOMUS Schoen.

Rhyparosomus Schoenherr, Gen. Curc., ii, p. 413, 1834.
,, Lacordaire, Hist. Nat. Insect. Coleop., vi, p. 332, 1863.

R. admonitus sp. nov. Type S.A.M.

Black, with dark grey and ashy-grey scaling, and covered throughout with broad flattened, erect and suberect setae; elytra with a whitish or pale greyish transverse fascia behind middle (often obscure).

Head convex, densely covered with greyish or dark greyish scaling, often with a paler, short, central stripe, forehead rugosely punctured, with a short, central furrow and a shallow indistinct one on each side,

all three being continuous with the rostral furrows, densely covered with dark, greyish scaling, and with 4 rows of short, flattened, pale or darkish, suberect setae, all 4 rows being continuous with the rows on the rostrum; rostrum much shorter than the prothorax, broad, scarcely curved, its sides dorsally narrowed from base to apex, the genae slightly dilated, with the upper surface more or less plane, densely covered with whitish scaling with three continuous furrows of equal length, and a row of short, thick, flattish, erect setae on each of the raised borders, the setae being paler, more whitish towards the apex, the genae with scattered white setae; antennae ferruginous, the scape abruptly clavate, reaching the posterior margin of the eye, with sparse, greyish scaling and dark setae, the funicle with finer setae, joint 1 of the funicle very nearly as long as the three next together, 2 longer than 3, joint 3 very slightly longer than each of 4, 5, and 6 subequal joints, 7 very slightly broader and longer than the preceding three joints; prothorax slightly broader than long, about as broad basally as long, with the apex shallowly constricted, the dorsal apical margin subtruncate or very feebly rounded and much narrower than the arcuate basal margin, the ocular lobes obsolete, the sides gradually dilated from base to beyond the middle, abruptly narrowed to apex, broadest before middle, with the upper surface slightly convex, rugosely punctured throughout, covered with dense, dark greyish scaling and with scattered, stout, flattened, suberect setae, with three lines of paler scaling, the lateral ones being broader; elytra elongate-ovate, with the basal margin deeply, conjointly sinuate, about as broad as the prothorax basally, the basal angles not projecting forwards beyond margin, the shoulders sloping, obliquely rounded, with no humeral tubercle, the sides subparallel from shoulders to beyond middle, thence attenuated to apex, with the upper surface convex, the striae indistinct, with shallow punctures obscured by dense scaling, with the suture and alternate intervals slightly more raised than the others and without any tubercles; intervals 3, 5, 7, and 9 generally with dark and pale, flattened, suberect setae, more or less arranged in 2 rows to beyond middle, thence in a single row; intervals 1, 2, 4, 6, and 8 with a single row of setae, those on 2, 4, and 6 being more widely separated; the surface with dense, dark greyish and ashy-grey scaling, with a transverse fascia beyond the middle from interval 4 to 4 on each side and interrupted at suture, as well as the apical part of striae 3 and 4 of pale or whitish scaling; legs with dense, dark greyish scaling, with pale and dark setae, the subapical annulation on the femora, a medial annulation and the apical part on the tibiae with whitish scaling, the medial and apical parts of the femora, the subbasal part and a central annulation on the tibiae dark; anterior tibiae not strongly curved near apex; tarsi ferruginous.

From six specimens.

Length (head excl.), 3½–4 mm.
Breadth, 1⅝–2 mm.
Hab.—Cape Colony—Stellenbosch (Dr. Péringuey).

This species is related to *mashunus* Mshl. It is, however, smaller, is differently coloured, has shorter, broader, and more flattened setae, has no humeral tubercle, and the basal angles of the elytra are not produced forwards in such a characteristic fashion.

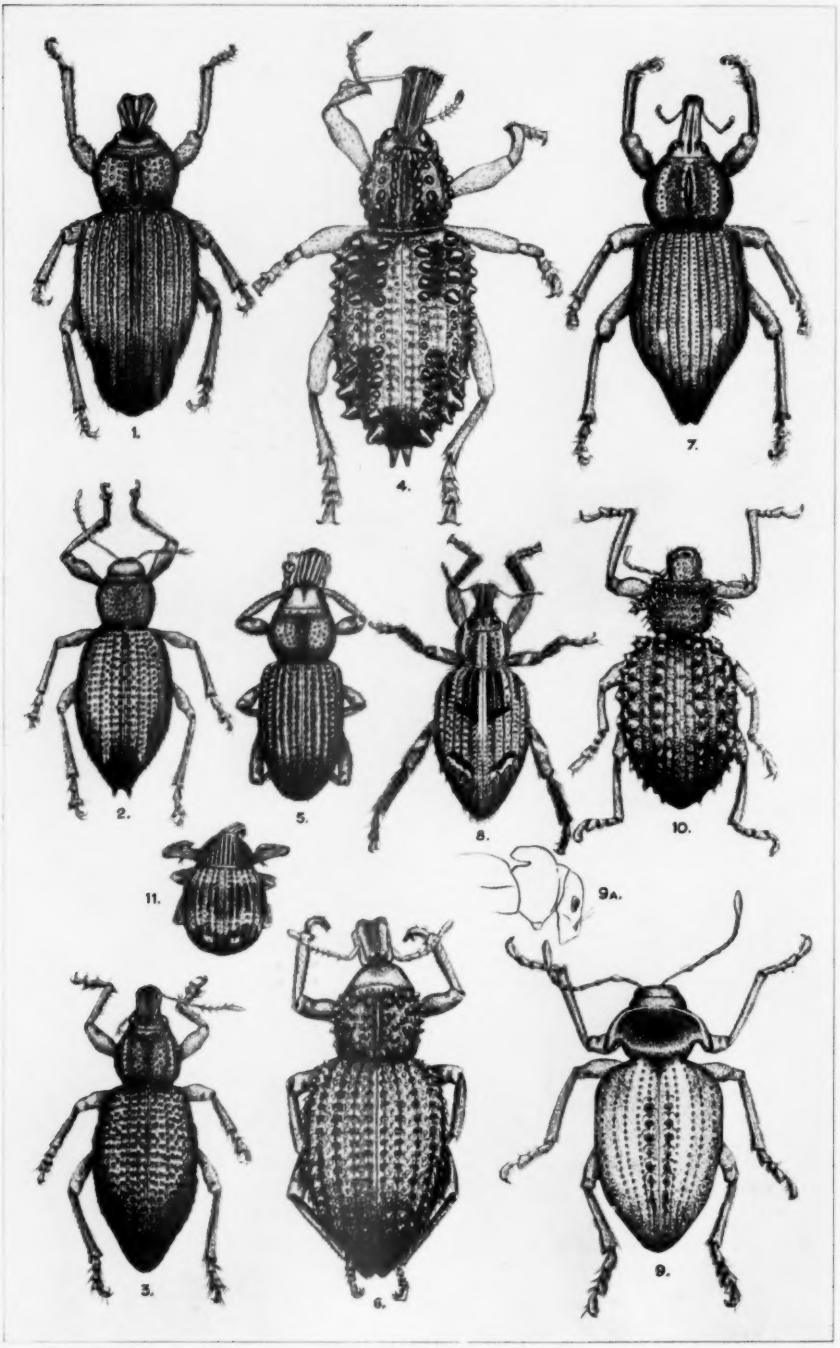
Sub-fam. **Otiorrhynchinae.**

Gen. SCIOBIUS Schoen.

Sciobius Schoenherr, Disp. Meth., p. 197, 1826.
„ Marshall, P.Z.S. Lond., vol. i, p. 236, 1906.

S. asper sp. nov. Type S.A.M.

Black; head slightly shorter than broad basally, slightly convex, with sparse punctuation and fine yellowish scaling, the forehead shallowly depressed in the middle; eyes moderately prominent; rostrum longer than broad, the genae only slightly dilated, with the upper surface plane, rugosely punctured, with yellowish scaling, tricarinate, with the medial carina obsolete and the lateral ones slightly curved inwards; antennae long, setose, with the scape slender, subcylindrical, slightly curved and abruptly clavate, with the third funicular joint much longer than the first, with the club oblong, acuminate, yellowishly, sericeously pubescent; prothorax more or less transverse, broader than long, truncate apically, sides slightly rounded, broadest at about the middle, subtruncate basally, with the upper surface convex, closely set with flat, smooth, rounded, shining granules, the interstices with a fine pale or greyish pubescence; elytra ovate, slightly broader basally than the prothorax, basally, conjointly, slightly sinuate, the sides rounded, broadest at about the middle, apically attenuated, conjointly rounded, with the upper surface convex, black, with obscure ferruginous spots dorsally and with large ferruginous patches laterally and on the inflexed margins, with striae containing rows of punctures separated by minute granules, which become less evident on the declivity, with the intervals slightly convex, and with rows of granules which are more apparent laterally and on the declivity, the interstices with fine, pale hair-like scaling; meso- and metasterna and the first abdominal segment granular with pale scaling; abdomen punctured, with pale scaling; legs with pale scaling; tibiae with a row of spines apically below; anterior tarsi (posterior ones missing) with joint 1 broader and longer than 2, 3 the broadest, 2 and 3 subequal and together slightly longer than 1.



A.J.H. del.

SOUTH AND SOUTH-WEST AFRICAN CURCULIONIDAE.

From a single specimen.

Length (excl. head), 6½ mm.

Breadth, 3½ mm.

Hab.—Cape Colony—Transkei, Kentani (Dr. Kolbe).

This species seems to be related to *pollinosus* Fahr., from which it differs by having minute granules on the intervals, by the first joint of the tarsi not being the broadest, and by having no central stria on the prothorax.

EXPLANATION OF PLATE.

FIG.

1. *Hipporrhinus fucosus* sp. nov.
2. ,, *sjöstedti* Mshl. (♀).
3. ,, *silvaticus* sp. nov.
4. ,, *solitarius* sp. nov.
5. ,, *truncus* sp. nov.
6. ,, *vastivagus* sp. nov.
7. *Solenorrhinus proteaphilus* sp. nov.
8. *Origens pulcher* sp. nov.
9. *Oncylotrachelus lobaticollis* sp. nov.

9*a*. Lateral view of prothorax of *O. lobaticollis*.

10. *Epichthonius rastricollis* sp. nov.
11. *Ocladius rupicolus* sp. nov.

OLEA LAURIFOLIA LAM. ("IRONWOOD"): AN INTRODUCTION TO ITS ECOLOGY.

By JOHN F. V. PHILLIPS, D.Sc. (Edin.).

INTRODUCTION.

Olea laurifolia Lam., the "Ironwood," * as a highly important tree ecologically, sylviculturally, and economically, has received some attention at the Forest Research Station, Deepwalls, Knysna, the object of the present paper being to record some of the salient features in its ecology.

A GENERAL DESCRIPTION.

Dimensions.—Adult "Ironwood" at Knysna attains a full height of 50–80 feet, with clean boles to 40 feet; the girth ranges from 5 to 8 feet (exceptional trees to 10 feet at breast-height are known).

Bole.—Usually cylindrical without marked fissuring, but at the base plank-buttresses are represented in a vestigial form.

Bark (in this case all tissue outside the phellogen, together with the secondary phloem).—Usually over $\frac{3}{4}$ to 1 inch thick; normally grey, but cream, pinkish, and mottled effects are not uncommon. The cork arises subepidermally, and consists of numerous rows of tangentially-elongated, thick-walled cells; this tissue is 1–2 mm. wide, and is strongly protective. At times abnormal development takes place in the vicinity of lenticels, or on wound stimulus—large, gnarled, corky excrescences being the result. In some individuals a "crocodile-skin" appearance is given to the whole of the bark by rectangular to square blocks of abnormally thick cork that arise. The cork-cambium is thus deeply seated; it is always vigorous and well defined. The primary cortex is made up of collenchyma with long bands of stone-cells running concentrically, and 100–200 μ wide; these are practically continuous in parts, much interrupted in others. Between these bands are strongly lignified rod-cell sclerenchyma and scattered stone-cells.

* The common names are confusing: at Knysna, *O. laurifolia* is called *Ironwood*, *O. capensis* L., *Black Ironwood*, whereas elsewhere in South Africa *O. laurifolia* is called *Black Ironwood*.

The secondary phloem shows numerous concentric bands of rod-cell sclerenchyma, 2–5 cells wide, interrupted by the medullary rays. It is the presence of the rod-cell sclerenchyma and stone-cells in the primary cortex and phloem that gives the marked rigidity and hardness to the bark of " Ironwood."

Crown.—Of the " inverted broom-shape horizontally extended " type, with numerous and heavy branches bearing a wealth of dark green foliage. " Ironwood " is the heaviest crowned species in the Knysna forests.

Roots.—The main roots are plank-buttressed on their upper surfaces. The system is of the " flat, with off-shoot roots descending sinkerwise, at 30–45° " form, and is comparable with the systems of *Ficus capensis*, *Ilex mitis*, and *Platylophus trifoliatus*. In respect to the depth of the general system, " Ironwood " falls within the class of " shallowest " rooted trees, the widespread roots finding their best development 12–18 inches, only, below the surface.

General.—The stump very rarely coppices, and the shoots seldom develop to large dimensions—this is contrary to the behaviour of *O. capensis* L., which coppices fairly freely. Tribolet (1923, pp. 449–50) describes the propagation of *O. europaea* by means of cuttings, truncheons, and suckers; experiments with *O. laurifolia* have shown propagation by these means to be most inefficient.

Distribution.

1. *General.*—*O. laurifolia* is found in all the forested portions of the country from Table Mountain to Knysna, and continues through the Eastern Province forests to those of the Transkei where it is less abundantly represented.

It occurs in Natal (being rare on the coast-belt), in the forests of the Transvaal, and is recorded from Rhodesia. The plant described as *O. macrocarpa* by C. H. Wright (1909) from the Zoutpansberg, from specimens in the Forest Department Herbarium (including No. 4329 of the old Transvaal Herbarium, cited by Wright), examined by the writer, seems to be identical with *O. laurifolia* Lam. of the Knysna forests. This matter is referred to further under " Notes on the Foliage." Sim (1907, p. 265) mentions that *O. laurifolia* occurs in Abyssinia, but apparently the plant to which he refers is *O. laurifolia* Hochst. (*i.e. O. Hochstetteri* Baker) (*vide* Flora Trop. Afric., iv, 1, 17).

The tree attains its finest development individually and collectively in the Knysna forests. In the forests of the Eastern Province, the Transkei, and Natal, the trees are neither so abundant nor so fine.

2. *In the Knysna Forests.*—In the *climax* forests of the Knysna region,

O. laurifolia is the best represented tree according to number of individuals above 1 inch in diameter at breast height. The following are percentage stockings based upon extensive enumeration transects run through unexploited forest: Gouna forest 17·7 per cent., Deepwalls 10·3 per cent., Kaffirkop 19·4 per cent., Harkerville 11·2 per cent., Blaauwkrantz 9·7 per cent., Lottering 10·3 per cent., Storms River 8·0 per cent. Precise data for other regions are not available, but from various references it seems that the percentage stocking is much lower in these than at Knysna.

Community Relations.

At Knysna the species is represented in the three *types* of forest, the *dry type* (mean holard at 18 inches depth 30–35 per cent. on dry-weight), the *medium-moist type* (45–60 per cent.), and the *moist type* (100–170 per cent.), but is by no means as abundant in the *moist type* as in the others; indeed the abundance and the reactions of *O. laurifolia* constitute two of the most important characteristics of these two *types*. The species is more abundant and much better grown in the *medium-moist* type than in the *dry type*.

While it naturally does occur in the *penultimate stages* of the principal *seres* leading to forest, within the Knysna region, it is essentially a constituent of *climax* forest. The major communities in which it is represented at Knysna are:

The Olea laurifolia Consociation.—The *consociation* (or climax community characterised by a single dominant) is usually of small extent, rarely more than 0·1 to 0·5 acre, and always is associated regionally with the *Podocarpus Thunbergii–Olea laurifolia–other spp. association* described briefly below. With the dominant may be smaller trees such as *Cassine croceum* Kntze, *Celastrus peduncularis*, *Plectronia obovata*, *Olea capensis*, *Gonioma Kamassi*. Dense layer-societies of *Trichocladus crinitus* and *Burchellia capensis*, 10–20 feet high, are usually present. Regeneration of " Ironwood " is usually poor, except as regards seedlings of *cotyledon* and *primary-leaf* stages.

The light and soil-moisture reducing reactions of the parent, together with fungus and insect diseases, are responsible for the gradual disappearance of the majority of these young plants.

The Podocarpus Thunbergii–O. laurifolia–other spp. Association.—The major dominants of this association (or climax community characterised by two or more dominants) are *Podo. Thunbergii* Hook. (*Podo. latifolius* R. Br.) and *O. laurifolia*. Associated with these, and playing the role of *dominants of lesser importance*, are large *Ocotea bullata*, *Apodytes dimidiata*, *Ilex mitis*, *Pterocelastrus tricuspidatus* Sond., and smaller trees such as

Curtisia faginea, Nuxia floribunda. Podocarpus elongata L'Herit. (*Podo. falcatus* R. Br.) occurs sparingly, if at all. The reaction of "Ironwood" upon the light-intensity is more marked than that of any of the other species, and it takes a greater toll of the soil-moisture. Layers of Trichocladus and Burchellia are present as a rule, but in the moister sites their place is taken by *Blechnum capense.* Regeneration stages of *Podo. Thunbergii* and of certain other species are usually well represented, but those of "Ironwood" not nearly as well.

This community constitutes the greater portion of the *climax* forests of *medium-moist* and *dry types.*

The Podocarpus elongata L'Herit. (Podo. falcatus R. Br.)–other spp. Association.—This much-mixed community consists of an upper story (80–130 feet) of *Podo. elongata* L'Herit. (Outeniqua Yellow-wood), the second story being composed by the taller individuals (to 90 feet) of *Podo. Thunbergii*, and the third by larger individuals of *O. laurifolia*, Ocotea, Apodytes, Curtisia, and other species, the first-named being the most abundant, and the most important ecologically.

A historical note of interest and of some importance may be made here. Prior to 1896, "Ironwood" was practically unsaleable, its value as a wagon and sleeper timber then being unknown. Accordingly, portions of forest exploited prior to 1897 were drawn upon for Podocarpus spp., Ocotea, Apodytes, Curtisia, and other merchantable timber species, but not for "Ironwood."

This selection-felling naturally considerably increased the relative percentage stocking of this species. Harison (1885, 1887) and Fourcade (1885) pointed out the undesirable nature of these selective fellings, and urged the use of "Ironwood" as a railway-sleeper timber. Hutchins (1891, pp. 38–39) stated that every "Ironwood" in the Knysna forests occupied the place of a more valuable tree, and indicated that the selection-fellings then in vogue, instead of converting the forests into "rich reserves of Stinkwood," would change them into "Ironwood wastes." He later (1893, p. 135) described "Ironwood" as the "*bête noire* of systematic forestry in South Africa." Attempts to rid the forests of this alleged useless species, by "ring-barking" at breast-height, were made by Hutchins, but fortunately with little success, the "rings" not being made sufficiently deep. A changed attitude toward "Ironwood" came about during the period 1896–1898; for example we find McNaughton (1897) writing that *O. laurifolia*, that once "was offered to woodcutters for nothing," in 1896 was sold to the extent of 57,000 cubic feet at 1d. per cubic foot. Since that time the timber has found a steady market, and the formerly despised "Ironwood wastes" have become a national asset, worthy of careful sylvicultural management.

Habitat Relations.

The general influence of the more important habitat factors upon the species is discussed briefly under factor heads below. It must be emphasised, however, that the writer is fully aware of the fact that the responses produced in the species by any one factor, and indeed by any particular intensity of any one factor, are governed in reality by the intensity of the other important factors constituting the factor-complex or habitat. The data presented are preliminary only, and will go to form the foundation for a more advanced study.

Light.—Judging from references in the correspondence of the earlier forest officers, " Ironwood " was considered to be not only a *tolerant* or *shade-bearing* species, but in addition, a *shade-demander*. Sim (1907, p. 265), however, definitely states that it is *scarcely a shade-bearer*, for, although it prefers dense forest it pierces the canopy and usually has a small but dense crown fully exposed above its neighbours. (Apparently his observations were made in the eastern forests, for at Knysna the " Ironwood " usually has a larger crown than equivalent-sized individuals of other species.)

Observations on the increment of trees and poles in areas suitably thinned, and as a result receiving light-intensities at crown-level two to ten times as great as they did in their natural state, support the view expressed by Sim. It is to be emphasised, however, that such increased increment is not the product of increased illumination only, but, in addition, of increased soil moisture and decreased competition for solutes.

Some intensive experiments concerning the responses of regeneration of " Ironwood " to light of different intensity have been carried out at Deepwalls, and may be summarised as follows :—

Cultures of *equal-sized*, very nearly *equal-weight*, cotyledon-stage seedlings growing *in soil of identical type*, were placed under intensities 1/40, 1/200, 1/500 (per Clements's Stopwatch Photometer) of full daylight, on 31*st January* 1925. The temperature and humidity of the air were practically the same in the three screens employed for the purpose, and the mean moisture content of the soils was kept at practically the same value in each culture ; in other words, the only effective factor difference was that of the light-intensity. On 22*nd August* 1927 the cultures reflected the following data :—

[Table.

Intensity.	Mean length of stem.	Mean diameter at collar.	Mean number of leaves.	Mean weight in grammes.			General nature.
				Fresh.	Dry.	Ash.	
	Inches.	mm.					
1/40	6·9	2·88	13	5·234	2·109	0·1083	Excellent.
1/200	4·7	2·15	12	2·494	0·960	0·0481	Good, but not as fine as above.
1/500	4·5	1·69	11	1·245	0·474	0·0260	Very fair.

Microscopic examination of representative leaves showed that the mean depths of the mesophyll were 272 μ, 176 μ, 110 μ, in intensities 1/40, 1/200, and 1/500 respectively. The palisade was 1-layered throughout, the mean depths being 32 μ, 20 μ, and 16 μ respectively; in no intensity provided did palisade appear on the lower surface. Spicular cells and sclerenchyma were fairly abundant under 1/40, were much less abundant under 1/200, and were poorly developed under 1/500.

A second experiment, carried out under natural forest conditions so far as the aerial factors were concerned, is worthy of brief description:

On 1*st July* 1925 seedlings of the same history, age, size, vigorous, and practically the same weight, were placed in containers holding soil of identical type. The soil moisture was suitably regulated, and the containers were sealed so that no additional moisture could reach the soil unless supplied through the stop-cocks provided for the purpose.

The cultures were placed under the following conditions, and on 1*st July* 1926 reflected the following data:

Site 1.—Under dense *Hemitelia capensis*, light 1/800–1/1000 during daylight hours. Fresh-weight mean, 0·5000 grm.; dry-weight 0·1739; ash-weight 0·0115. Plants very fair. Mean depth of mesophyll, 256 μ.

Site 2.—A few yards from Site 1, Hemitelia removed, light 1/80–1/100 during daylight hours; humidity and temperature practically unchanged. Fresh-weight mean, 0·6936 grm.; dry-weight 0·2786; ash-weight 0·1500. Plants more vigorous than at Site 1. Mean depth of mesophyll, 288 μ.

The experiments described indicate *that, while "Ironwood" regeneration can withstand dense shade conditions and still appear to be of very fair vigour, better growth is produced under stronger illumination.*

So far as his experience goes, the writer would describe "Ironwood" as a better shade-bearer in its youngest stages than most of the other

economic species in the Knysna forests, but as requiring strong light conditions—not above 115 of full sunlight—for its best development.

Temperature.—The species is best developed between 500 and 2000 feet within the Knysna region, and does not favour the higher altitudes of this portion of the country, although found at 3000–4000 feet in the eastern forests. It is definitely frost-tender, the foliage being readily desiccated if strong sunshine or high wind follows a severe frost.

The young regeneration is markedly sensitive to insolation. The first-stage seedlings of the more important species of trees in the Knysna forests have been studied in respect to their resistance to high surface-soil temperatures, which produce " insolation lesions " at the collars of the young plants. " Ironwood " seedlings are placed in the class " *lesioning most readily.*" If the temperature of the surface-soil of an exposed site reaches 150° F., and remains at or near this temperature for more than thirty minutes, a constriction or " lesion " is formed at the collar of the seedling experiencing this temperature ; this cortical constriction results either in inhibited growth or in death.

Very large numbers of first-stage " Ironwood " succumb on sites that have been exploited too severely and have not been covered with a dense carpet of weed. Factors definitely governing the degree of injury caused to the plants by the high surface-soil temperatures, are humidity of the air, moisture-content of the soil, and soil texture.

Older seedlings and saplings, on exposure to severe insolation, suffer from " *sun-scorch* " of the leading shoots and of the younger foliage, the leaves assuming a yellow tint, and often falling soon after. The larger pole, small tree, and adult stages, however, are capable of experiencing strong direct sunlight and high air temperatures without suffering in the least, provided the soil-moisture conditions are favourable at the time. In a word, " Ironwood " behaves in the same manner as Ocotea, Apodytes, Platylophus, Curtisia : in its earlier stages it is markedly insolation-tender, in its later youth, its medial stages, and its adult form, it is relatively hardy to insolation, other factors being favourable at the time of trial.

In this connection, the behaviour of the adult, exposed foliage of " Ironwood," and of several other species of trees growing under practically identical environmental conditions at the laboratory, Deepwalls, on experiencing an unvarying air temperature (with a regulated humidity), is of interest. The method of comparison adopted was that described by Bews and Aitken (1923, pp. 44–56), and consisted of submitting practically turgid leaves to an incubator temperature of 25° C. (77° F.), and weighing these at definite intervals, and ultimately finding the dry-weight of the leaves after drying to constant-weight in a steam-oven at 105° C.

In the space available it is impossible to give the data at all fully, hence

the conditions at the end of five hours drying—humidity 57 per cent. during this period—will be summarised. The maximum water-contents of the foliage expressed as a percentage were: *Cunonia capensis* 88·7 per cent., *O. laurifolia* 86·6 per cent., *Ocotea bullata* 78·9 per cent., *Podocarpus elongata* L'Herit. (Outeniqua) 75·4 per cent., *Podo. Thunbergii* Hk. 74·8 per cent.

Foliage taken from seedlings growing under identical environmental conditions in a culture-screen at the laboratory, and submitted to the same temperature and humidity conditions in the incubator, at the end of five hours reflected the following maximum water-contents expressed as a percentage: *O. laurifolia* 87·5 per cent., Cunonia 81·6 per cent., Ocotea 81·5 per cent., *Podo. Thunbergii* 77·5 per cent., *Podo. elongata* L'Herit. (Outeniqua) 77·4 per cent. In both experiments it is seen that the foliage of *O. laurifolia* lost relatively small amounts of water.

Soil-moisture.—The best development of "Ironwood" takes place in the *medium-moist type* forest at Knysna, the mean holard of which at 18 inches is 45–60 per cent.; within the *dry type* (30–35 per cent.), the tree is much less vigorous and the timber more liable to contain flaws charged with a viscid, black exudation; the dimensions of bole and crown are generally much less than in the *medium-moist type*, but the root-system is generally wider spread.

"Ironwood" is relatively scarce in the *moist type* (100–170 per cent.), but some fine individuals may be found on better-drained slopes within this *type*.

Experimental regulation, for twenty months, of the moisture-content of the soil of containers $9 \times 9 \times 18$ inches, in which fifteen plants of *O. laurifolia* were grown per container, showed the following ultimate results: *mean moisture-content* 20 per cent.; ratios of fresh, dry, and ash weights, 100, 100, 100 respectively: *mean moisture-content* 40 per cent., ratios of fresh, dry, and ash weights, 187, 175, 187 respectively: *mean moisture-content* 60 per cent.; ratios of fresh, dry, and ash weights, 126, 114, 120 respectively. From these figures it is perfectly clear that the 40 per cent. moisture-content produced the best results; this finding is being supported by additional regulation experiments and by field investigations.

According to various references in the reports of forest officers from about 1891, it seems that large "Ironwood" have been noted to die during abnormally dry seasons, in the eastern and Transkeian forests.

How much of this mortality is directly due to lack of moisture and how much to the parasitic fungus *Fomes applanatus*, or to the combined influences of drought and this parasite, has not been investigated; it is worthy of note that Sim (1907, p. 265) refers to the effects of drought during the very dry season of 1898, many large "Ironwood" dying in the eastern forests. In the Knysna forests—so far as the writer's experience during five years'

work therein has revealed—where the rainfall is usually high and usually fairly well distributed, death *directly* due to drought is not common except in the very driest portions on shallow-soiled ridges and on Bokkeveld beds. It is noteworthy, however, that toward the end of periods of relative drought for this moist region, the larger, older " Ironwood " *on the poorer sites*, show thinning of their topmost foliage ; growth at such times must be either nil or very slight. Drought during the fruiting season brings about the *premature* fall of the drupes, especially on poor-soiled, drier ridges and on Bokkeveld soils.

The reaction of the larger " Ironwood " upon soil-moisture is marked in virtue of their possessing large crowns and flat root-systems.

During relatively dry periods the drain upon the water in the layers 12–18 inches deep, reduces the holard to points near to or equivalent to the wilting coefficients for the particular soil type and for the cotyledon-stage of " Ironwood " regeneration. Quadrat studies show that in such dry periods, death from wilting sometimes carries off 25–50 per cent. of the seedling crop of this stage.

Organic Matter.—The return of leaf and small twig litter by the average " Ironwood " adult is considerable, despite the fact that the evergreen leaf may remain as long as three to five years upon the branchlets. Upon one square metre of the zone influenced by the crown, the oven-dry-weight of " *Ironwood* " *foliage* may range from 5–10 ounces.

First-stage regeneration prefers a germination bed on which the organic matter is not too great ; young plants produced upon beds with super-abundant organic matter both decomposed and undecomposed, are liable to fungus and insect diseases, and to succumb from drought as the delicate radicles become desiccated on account of the open texture of the humus-rich upper layer of the soil.

Hydrogen-ion-concentration.—The range of pH values of the soil solution experienced by " Ironwood " is relatively wide. In the *dry* and *medium-moist types* on Table Mountain Sandstone-derived soils, the ranges are pH 5·3–4·7 at 1–2 inches, 5·6–4·9 at 9–12 inches, and 5·7–5·0 at 18–24 inches, while in the *moist type* the ranges are pH 4·0–4·8 at 1–2 inches, 4·7–5·0 at 9–12 inches, and 4·9–5·3 at 18–24 inches.

First-stage regeneration of the species, therefore, experiences the wide range of pH 4·0–6·0 approximately ; it is usually of poor quality and readily succumbs to fungus diseases, in humus-rich soils, with pH values lower than 4·8. Pole and small tree stages experience a range pH 4·7–7·0, adult trees a range 4·9–7·3 approximately. The best development takes place in forest with the range pH 4·9–5·5 at 9–12 inches and pH 5·0–5·7 at 18-24 inches, soil-moisture, depth and other edaphic factors, as well as aerial factors, being suitable.

Wind.—On account of its possessing an extremely heavy, full-foliaged crown, a tall and heavy bole, and root-system superficially developed, " Ironwood " is highly susceptible to injury from wind-storms.

The branchlets are somewhat brittle and fall readily, the drupes are tossed to the ground in thousands, while an appreciable number of trees is uprooted. Boles attacked by *Fomes applanatus* (*vide* " Mortality Factors " below) rupture at points of weakness, often within ten feet of the butt.

When the probable total influence of wind upon " Ironwood," over long periods, is taken into consideration, it seems reasonable to believe that the stocking of the species must have been improved appreciably through this very influence. As described under " Light," the abundant regeneration is subjected to light of very low value, normally, and accordingly grows slowly or succumbs. The removal of a number of umbrageous parents many decades before they would have fallen normally, serves as a stimulus to the young plants, and to the seeds as yet ungerminated.

The Foehnlike " Berg " winds from the north and north-west that commonly blow during the autumn, winter, and early spring months, in the Knysna region, reduce the humidity below 20 per cent. and raise the temperature to 80–100° F. These parching winds desiccate the tender shoots of " Ironwoods," and cause some destruction to the flower and fruit crops.

Symbiotic Factors.—No mycorrhiza occur in the roots, and no other form of symbiosis has been detected. This negative condition intentionally is made clear here, as it seems that it was quite a popular idea with the earlier foresters and botanists to associate the supposed occurrence of symbiotic organisms with the South African forest trees. Suffice it to say that of the sixty-six species of trees and large woody shrubs examined by the writer, three species only have shown symbiotic relations: *Podocarpus* sp. and *Virgilia capensis*.

Notes on the Foliage.

The leaves are most variable in size and shape, according to age of the tree, position on the tree, and nature of the particular environment. They may be 1½–4 inches long by ¾–2 inches wide on adult trees, and rather larger on shaded saplings and poles. They may be elliptic to widely lanceolate. Above they are dark-green, shining, smooth; below, pale dull-green. The mid-rib may be slightly raised on the upper surface; petiole ⅓–½ inch long.

Anatomical details have been given by Gerhard (1902, pp. 24–26) in a paper now very difficult to obtain, and apparently little known to South African botanists.* In general the writer is in agreement with Gerhard's description, except that he does not hold with the statement that the leaf

* The writer is indebted to Dr. R. Marloth for a loan of this paper.

is *isolateral* (p. 41). There certainly is a palisade-like row of elongated cells immediately above the lower epidermis, but these by no means go to make the leaf *isolateral*, in reality it is *bifacial*.

The general structure is very much as in *O. europaea*, indeed the same *general* features are shown by the other South African species examined (*O. capensis*, *O. foveolata*, *O. exasperata*, *O. verrucosa*). The conditions may be summarised :

The main vascular bundle is definitely arc-shaped, with a 2–4 layered arc of isodiametric-rectangular sclerenchyma, more or less without lumina, in the pericycle ; stout collenchyma with scattered stone cells occurs above and below the main bundle. The upper cuticle is glabrous, 15–18 μ deep in exposed leaves, and shows undulate striation ; the lower cuticle in exposed leaves closely approaches the depth of the upper cuticle, but in shade leaves may be 4–8 μ thick only ; it is more papillose than the upper. Peltate, unicellular-stalked hairs with variously shaped heads occur on the ventral surface, but are either absent from the upper surface or are far scattered. The upper and lower epidermal layers are identical-isodiametric-rectangular, 15–18 μ deep, with thick lateral walls. The upper palisade is usually 2-layered; long narrow cells (upper cells 40–50 μ, lower 40–55 μ long), width 8–15 μ ; collecting cells link the above with the 6–8 layers of the spongy-parenchyma. In exposed leaves a definite lower palisade of 1–2 layers occurs, the cells measuring about 35–45 μ (upper) and 25–30 μ (lower), their width being 15–20 μ. Shade leaves show either one short layer or no palisade at all. There is a remarkable development of spicular cells, more or less without lumina, width 12–20 μ, their length variable and often very great, extending from epidermis to epidermis ; they are developed at every possible angle, and are most abundant in the spongy parenchyma ; multiradiate forms occur. Scattered stone-cells are found with the spicular cells, these conjointly giving the leaf its marked rigidity. Stomata are found on the ventral surface only—sunken slightly—with or without peltate hairs in the depressions ; the guard-cells have no subsidiary cells. Calcium oxalate in acicular crystals is very abundant throughout the tissues.

On the whole the leaf has a xerophytic tendency, being well protected against desiccation in virtue of the possession of deep cuticle and well-sunken stomata ; probably the low water-loss on the leaf being exposed to high temperatures is to be accounted for by the presence of the foregoing.

The foliage of *O. laurifolia* and *O. capensis*, in the absence of flowers and fruits, is often confused by botanists and foresters. The leaves of these species are readily distinguishable in that the walls of the dorsal epidermal cells of *O. laurifolia* present a definitely wavy appearance in superficial section, whereas *O. capensis* shows stouter, non-wavy walls.

The foliage of the so-called *O. macrocarpa* C. H. Wright (Fl. Cap., vol. iv, pt. 1, p. 1129) from the Zoutpansberg anatomically is indistinguishable from that of *O. laurifolia*; this fact, together with the similarity in the anatomy of the "bark" and the similarity in the flowers and fruits, leads the writer to think that the plants are co-specific.

The variety *concolor* Harv., described in the Flora Capensis (vol. iv, pt. 1, p. 487) as possessing obovate leaves, "the same dull green on both surfaces," is unknown to the writer. From the fact that this variety is cited as being identical with *O. concolor* E. Meyer (described in Comm. Drege, vol. ii, p. 176), a small shrub "found on Campbell commonage and other north-western localities"—Sim (1907, p. 264), and possibly a dwarf form of *O. capensis* L. (teste Sim), some confusion in the Flora Capensis is suspected.

Several large trees bearing striking "*aurea*" and "*aurea-variegata*" foliage have been found by the writer in the forests near Deepwalls. The anatomical details of these forms are identical with those of the ordinary form except that much less sclerenchyma and fewer spicular cells are present.

The Biology of the Flowers, Fruits, and Young Regeneration.

Pollination.

The minute creamish-white flowers are borne in showy terminal panicles 2½–3½ inches in length and about the same width at their broadest portions; from several dozen to several hundred flowers are borne per panicle.

The two epipetalous stamens possess yellow anthers which open by extrorse slits. The two-celled ovary possesses two pendulous ovules per cell attached to the inner walls; these ovules are well developed at time of pollination, and thus differ from those in the genera Fraxinus and Forsythia, which, according to Goebel (1905, vol. ii, p. 623), are quite rudimentary at time of pollination. Nectar is secreted by the ovary and is concealed at the base of the waxy corolla; it emits a medium-strong, sickly sweet odour much like that of Ligustrum flowers.

Observations and pollination experiments during three flowering seasons show that the *honey bee* is primarily responsible for pollination; the bee seeks *pollen*, rarely the *nectar*. Various unidentified smaller Diptera are attracted to the flowers by the sickly odour, but in reality play very little part in pollination. The Nectariniidae rarely visit the flowers, and then usually in quest of insects. Self pollination takes place. Judging from the numbers of flowers per panicle (on marked trees) that develop to the first stage of the fruit, effective pollination takes place in about 21–40 per cent. of the total number of flowers produced.

Season and Life-history of Flower and Fruit Production.

The spacing of the flowering seasons is subject to some variation according to individual tree and locality. The majority of trees since 1921 (references indicate that there were flower crops in the years 1917, 1919, 1921) have produced flowers every other year—that is, during the periods January to May 1923, 1925, 1927. Some trees, however, bore flowers in 1923 and 1927 only, and some in 1925 only; a very few flowered in 1924 and in 1926 only. For the Knysna forests it is permissible, therefore, to generalise that the flowering seasons may occur at intervals of two to four years, with a few trees bearing at three-year intervals. Judging from the all too sparse records of flowering since about 1913, it seems that this variation is a feature of the species.

Flower crops usually produce fruit crops, but some trees produce full fruit crops spaced by four to more years.

So far as months of the flowering year are concerned, proximity to the ocean and conditions of the particular habitat in respect of aerial and edaphic temperatures, light conditions available for the crown, and quantity of soil-moisture, play important parts; nearer the coast and as the west is approached the flowering is earlier by four to eight weeks. Trees on the northern, north-eastern, and north-western slopes usually flower before those on the cooler, less bright, moister southern, south-eastern, and south-western. Trees in the valleys, where the aerial and edaphic temperatures are lower and the moisture-content higher, are much later than those on the ridges experiencing a warm exposition and a lower moisture-content.

The following *behaviour table* for a series of trees growing in the Deepwalls forest (1000–1700 feet), with necessary adjustment for altitude, is typical for the species in the Knysna forests:—

Period.	Behaviour.
(1) mid-Dec.–mid-Jan. .	Flower buds appear.
(2) mid-Jan.–mid-Feb. .	First flowers open; bees visit these.
(3) mid-Feb.–early Mar.	Flowers of (2) fertilised, corollas faded and falling; main flower crop open; bees at maximum.
(4) early Mar.–late Mar.	Flowers of (2) produce minute green fruits; main flower crop of (3) is fertilised; late flowers opening; bees few.
(5) late Mar.–late Apr. .	Flowers of (3) produce minute fruits; late flowers of (4) fertilised; bees have departed. Fruits produced by flowers of (2) still minute.

Period.	Behaviour.
(6) about early Jan. (of following year). .	Fruits produced by flowers of (2) more or less their full dimensions, but still *immature*, the endocarp walls being relatively soft, the embryo under-developed, the pericarp non-succulent and green. Bush-doves and Turacus visit in large numbers, dislodging the immature drupes.
(7) late Feb.–mid-Mar.	The pericarps of the drupes mentioned in (6) are dark purple, highly succulent; the endocarps are fully hardened, the embryos full-sized. Birds increase as the flowers of (3) have produced large sub-succulent fruits. Falls of ripe and immature fruits considerable, owing to birds, and wind.
(8) mid-Mar.–mid-Apr.	Mature drupes persist if undisturbed, but usually are dislodged by birds, wind, or a stalk-attacking fungus. Most of the fruits of flowers of (3) now mature. Birds at maximum.
(9) mid-Apr.–mid-July .	Drupes fall naturally; fall through agents of disturbance at maximum. Birds very abundant.
(10) mid-August . .	All drupes fallen.

The Fruits and Seeds: Their Nature and Dispersal.

*Nature.**—The *fruit* is a shortly-stalked, ellipsoid to pyriform drupe (shape varying greatly according to tree or even part of tree, and locality) ¾–1 inch long by ⅓–½ inch at its greatest diameter. On account of the abortion of three ovules of the four within the ovary, one *seed* only is present within the endocarp (on rare occasion a 2-seeded endocarp is found, both embryos of which may develop to healthy seedlings). The seed is supplied with much fixed oil and abundant ruminate albumen; the cotyledons are large and fleshy, the embryo being straight. The *endocarp* is ellipsoid, and possesses extremely hard walls, these being 1–2 mm. thick and constituted of isodiametric sclerotic cells practically without lumina.

The pericarp is dark purple and secrets a large quantity of fixed oil of the same kind as occurs in the seed—probably a *glyceride of Oleic acid*; the oil accounts for 50–80 per cent. of the fresh-weight of the pericarp, and resembles that of *O. europaea* in taste. *This oil plays an important part in the biology of the seed:* (*a*) largely on account of its presence the unfallen drupes

* Fruits of the so-called *O. macrocarpa*, C. H. Wright, are identical with those of *O. laurifolia* in all respects.

are much sought by birds, and the fallen drupes are relished by certain mammals; (*b*) it acts as a lubricant or aperient upon the digestive organs of the birds or mammals feeding upon the drupes and swallowing the unbroken endocarps, the latter being passed out more rapidly, and less impaired, than they would be were the rate of progress through the systems less rapid; (*c*) it prevents the rapid desiccation of the pericarp and thus preserves the vitality of the newly-mature embryo; (*d*) it and the shrivelled remains of the pericarp form an insulating cover to the endocarp, inhibiting germination for lengthy periods—that is, increasing the dormant capacity.

Quantity Produced.—As many as three to four dozen drupes may be borne per panicle, a large tree bearing from 3000–10,000 mature drupes, weighing from 15 to 50 lbs. when fresh. The drupes are usually so numerous as to impart a touch of dull purple to the green ensemble of the crowns. During a fruiting season the forest floor in the vicinity of large " Ironwood " is literally covered with immature and mature drupes, every square metre showing hundreds of drupes.

Fertility.—As in *O. europaea*, endocarps with fertile seeds can be separated from those with unfertile by soakage in a 10–25 per cent. solution of sodium chloride—the fertile-seeded individuals sinking; this method, together with an examination of dissected drupes establishes the fact that the *germinative capacity* ranges from 50–80 per cent. Sowings of selected " seed " under natural conditions and in nurseries shows that about 50–75 per cent. of the *viable* seeds actually germinate, the remainder falling to the ravages of parasitic organisms, or being acted upon uncongenially by the community and physical habitat factors. On account of the large numbers of drupes produced each fruiting season, the fertile drupes that do germinate are really very, very abundant.

Germination.—On germination the endocarp splits longitudinally, allowing the exit of the radicle; germination is *epigeal*, the partly-gaping endocarp and membranous case remaining upon the adpressed apices of the stout, fleshy olive-green cotyledons for several days or weeks. In " Ironwood," as in *O. europaea*, unless the pericarp is removed or severely ruptured, germination is long delayed; as has been mentioned above, the Oleic glyceride within the pericarp is partly responsible for this delay. Normally a pericarp-clad drupe remains from twelve to eighteen months in a dormant condition; by the end of this period the oil has disappeared and the pericarp has disintegrated, and germination is able to take place.

As Phillips (1923, p. 211; 1926 (*a*), p. 404; 1926 (*b*), p. 658; 1927) previously has pointed out, the period required for germination is reduced appreciably on the endocarps being passed through the systems of birds and mammals. Passage through the systems of Potamochoerus (Wild Pig)

and *Columba arquatrix* (Bush-dove), for example, removes the pericarp and bathes the endocarps in the chemically active enzymes. The endocarps are voided with or without excreta adhering to them, and if the community and habitat factors be favourable, germinate within four to six months. The influence of pericarp removal by mere mechanical means is not nearly as marked as that of passage through the systems of the " Wild Pig " and the " Bush-dove," the period necessary for germination being reduced by a few months only. It is of interest to note that soakage of such mechanically cleaned endocarps in very dilute acids (such as 1/10,000 acetic or citric) and in very dilute iodine solution, accelerates germination by several months as compared with the rate of germination in endocarps cleaned but not soaked. That some *physiological stimulus* is set up in the instance of the enzymes as well as in that of the chemical solutions, is possible ; the actual softening effect of these upon the chitinous walls seems negligible.

It is worthy of note that experimental " clipping " or " cracking " of the endocarps did not accelerate germination as is the case in *O. europaea* —none of the " clipped " or " cracked " individuals retaining their vitality.

Capacity for Lying Dormant.—Undisturbed drupes lying in conditions not definitely conducive to germination—*e.g.* on sites where the mean air temperature is low, where there is a dense carpet of leaf-litter between the soil and the fruit, and where the moisture is insufficient—may remain viable for periods ranging from eighteen to thirty-six months after their fall, provided they escape the attacks of fungus and insects. On alteration of the factors of such environments in the direction of more congenial germination conditions, these long-rested endocarps speedily germinate, producing perfectly viable seedlings.

Dispersal : (*a*) *Aggregation.*—Of the total *mature* drupe crop produced by the average " Ironwood," about 50 per cent. falls on the crown-influence zone. It is important to record that the actual degree of aggregation under many trees is considerably higher than 50 per cent. of their mature crops, for the reason that dispersing birds void large numbers of drupes collected from *other* trees while in the act of feeding from, or resting in, the trees of the class being discussed.

In such instances, while the result may be an *aggregation* of drupes under trees of the same species, the process of accumulation is one of combined *aggregation* and *migration*. As many as 500–1000 mature drupes may be found per square metre under large, heavily fruiting trees.

(*b*) *Migration.*—Phillips (1923, p. 211 ; 1925 ; 1926 (*a*), pp. 374, 402 ; 1926 (*b*), p. 658 ; 1927) elsewhere has described the migration of "Ironwood," but a summary here is not out of place.

The prime agents are : (i) *Columba arquatrix* (Bush-dove). This is by

far the most important agent; it carries up to eighty drupes in its " crop " and up to twelve endocarps in its gizzard at one and the same time; about 50 per cent. of the fruits taken are dispersed unbroken, the distance of spread being from a few yards to several miles. (ii) *Turacus corythaix* (Loerie) is an agent of some importance, visiting trees in pairs, and at times in large numbers; it removes many thousands of drupes, most of which are passed unbroken. (iii) The doves *Chalcopelia afra* and *Haplopelia larvata*, and *Lophoceros melanoleucus* (Hornbill) and *Amydrus morio* (Rooivlerk) disperse a fair number of drupes. (iv) *Potamochoerus choeropotamus* (Wild Pig): fallen drupes are dispersed long distances; the proportion of broken endocarps depends upon the amount of fruit available—the larger the amount the more greedily does the pig partake (swallowing the morsels without much movement of the jaws) and the larger the proportion of uncrushed endocarps. (v) *Baboon, Monkey*: large numbers are dispersed, but the greater proportion is severely crushed. (vi) Of lesser importance are the " Fruit Bat " (*Rousettus collaris*) and the elephant, the last named removing the drupes by mere chance and not by design. (vii) Domesticated dogs, pigs, and fowl and duck relish the drupes, voiding the endocarps largely unbroken. (viii) The drupes are sought by some people who consider them highly palatable, and comparable with the European olive; the fruits are collected, the endocarps being rejected after removal of the pericarp.

Regeneration.—The seedlings are produced with large fleshy cotyledons which remain in position up to twelve months, persisting even after the primary leaves have appeared. The plants are usually vigorous when disease-free, but under natural forest conditions do not grow more than 0·5–1 inch per annum for the first five to ten years.

Cotyledon-stage plants on many sites cover many metres of the forest floor, forming a dense carpet, some square metres containing as many as 500–1000 plants. As a result of the mortality factors described below, 50–100 per cent. of these seedlings succumb ere they attain the *cotyledon and primary-leaf* stage or the *primary-leaf* stage.

It is an interesting fact that while *cotyledon-stage to three-year-old* seedlings are relatively abundant, and pole, large pole, small and large tree stages are usually well represented, the *large seedling, small sapling* and *large sapling* stages are relatively sparse. A factor that requires consideration in this connection is the influence not only of fungus and insect foes, but also *the marked moisture and light-reducing* reactions of the dense layers of *Trichocladus crinitus*, generally a feature of forest in which " Ironwood" is abundant. The individuals immediately above the light-reducing influence of the Trichocladus—that is the small pole, and pole stages—may be the result of many, many years' regeneration, the variously aged survivors of

seedling, small sapling, and sapling-stage hordes that have been produced during many decades.

Rate of Growth.

"Ironwood" is comparatively slow-growing, being outstripped by *Olinia cymosa*, Ocotea, Apodytes, Curtisia, Podocarpus spp. of the better class timber trees; the fine large individuals of the species in many instances are probably not less than 300–500 years of age. The following mean data give an impression of the rate of growth in girth in natural, dense forest at Knysna :—

Girth-class (inches).	Mean annual girth-increment (inches).
3–6	·07
7–12	·09
13–18	·15
19–24	·21
25–30	·20
31–36	·22
37–42	·21
43–48	·21
49–54	·20

Height-increment observations have been made for seedling and small sapling stages growing under natural dense forest conditions; the figures range from 0·5 inch to 6 inches per annum.

Under suitable conditions of light and competition for soil-moisture, the girth and height increments are 50–200 per cent. greater than in natural forest.

Mortality Factors.

The species is liable to the following pests and diseases :—

The Flowers.—A Psyllid found abundantly upon *O. capensis* L. occasionally kills the flowers of "Ironwood" by sucking the juices from the axes of the panicles; on account of the large production of flowers, the damage done is of little importance.

The Fruits and Seeds.—Approximately 25–75 per cent. of the drupes fall *prematurely*: the prime reasons for this are: (i) wind—strong gales cast large numbers; (ii) congregating birds feeding upon the immature fruits dislodge many in the act of selecting their fare; (iii) an unidentified fungus attacking the fruit-stalk and causing weakness therein.

Large immature fruits are attacked by the fruit-fly *Afrodacus biguttulus*

which destroys the pericarp, causes premature fall of the drupe, and death of the immature embryo. The fly *Munromyia nudiseta* attacks the embryo.

Seedlings.—Phillips (1923) elsewhere has described some of the diseases of the regeneration. The cotyledon-stage seedlings succumb in large numbers to *Fusarium* sp. which causes " damping off." The whole seedling crops of many trees are destroyed by this organism, which spreads rapidly. It is also exceedingly troublesome in nursery beds. Older seedlings suffer greatly from a *Corticium* sp. causing a severe root-rot; this disease does not spread rapidly, but gradually accounts for all the plants on a given area; it is more abundant on sites where the soil-moisture is high and the *p*H values low; this organism attacks other indigenous tree seedlings, and has been found on the roots of *Pinus insignis* and *P. pinaster* in the Knysna region. *Asterodothis solaris* kills a very small proportion of the smaller seedlings, and is responsible for a certain amount of growth-inhibition in older plants; it spreads slowly, and is not nearly so potent a disease as *Fusarium* sp. and *Corticium* sp. above mentioned. The only insect disease of any importance is caused by an unidentified Coccid attacking cotyledon-stage and primary-leaf-stage seedlings, which either die or remain stunted; the insect spreads very slowly.

Older Stages.—*Fomes applanatus* (Pers.) Gill. is a widespread *facultative* parasite of " Ironwood " boles of all ages, causing delignification of the tissues, and being responsible for inhibited growth and often for the death of the tree. The large bracket-like fructifications are found at various heights above the ground, sometimes near ground-level, sometimes in the upper crowns. Wounding of the roots or bole enables the fungus to find congenial sites for establishment, or it may commence life on a tree as a saprophyte on dead tissue. Trees attacked are liable to be broken by the wind at points of weakness, often within 10 feet of the ground.

The total amount of damage done by this fungus per annum must be considerable. Van der Bijl (1918, p. 485) has described its effects upon the timber of " Ironwood."

Other wood-attacking fungi, occasionally parasitic, on boles of " Ironwood " are *Fomes rimosus* Fr. (sometimes with severe effects) and *Stereum hirsutum* Fr.

It is worthy of note that the " Ironwood " although possessed of an exceedingly hard and heavy wood and a thick, well-lignified " bark " is extremely sensitive to injury. The superficial roots, for example, if bared of their bark during exploitation operations, soon become infected by *Fomes* spp. and form centres for the general disease and ultimate death of the tree; broken crowns, in like manner, are speedily attacked by fungi which rapidly bring about further loss of crown.

Conclusion.

"Ironwood," on account of its abundance, its strong light-reducing reaction, its superficial root-system which draws largely upon the moisture of the upper 18 inches of the soil, its marked attractive influence during its fruiting-season upon the "Bush-dove," other birds, and some mammals, and the large amount of long-resting fruit it produces, is of considerable ecological importance in the Knysna forests of *medium-moist* and *dry types*. Despite its slowness of growth and the various disabilities to which it is subject, the species is fully capable of holding its ground, and even of increasing its frequency if not kept in check. The value of the timber and the steady demand for this, combined with the importance of the ecological rôle of the species, indicate that it is well worth the sylvicultural attention the Forest Department of the Union of South Africa is giving it.

Summary.

1. *O. laurifolia* Lam., an important tree ecologically, sylviculturally, and economically, is described as to dimensions, habit, general distribution, and distribution within the Knysna forests; the principal communities in which it is an important species in the Knysna forests are discussed.

2. The more important habitat relations are outlined, experimental work being referred to where necessary. The plant is capable of bearing light of very low intensity but grows best under strong light; in its early youth it is definitely insolation-tender, but at later stages can withstand high temperatures without injury; it is best developed in *medium-moist* forest (45–60 per cent. holard), not so well in *dry* type (30–35 per cent.), and does not thrive under very moist conditions; its *p*H range at Knysna is very wide; being a shallow-rooted species with a very heavy crown it is readily thrown by heavy winds.

3. The foliage is described anatomically; the writer does not agree with Gerhard's statement that it is an isolateral leaf; it is bifacial. The principal features are the thick cuticle, the sunken stomata, the peltate hairs, the development of sclerenchyma in the pericycle, the deep palisade on the dorsal portion of the leaf and the single-layered palisade of the ventral, and the large spicular cells that give the leaf its rigidity.

4. The flowers are pollinated by bees seeking pollen; the degree of *effective* pollination ranges from 21–40 per cent. of the flowers produced. The flowering seasons occur at intervals of two to four years (Knysna); a table summarising the flowering and fruiting behaviour is given; the fruit is described; the oil of the pericarp is shown to play an important rôle in the biology of the seed; the germinative capacity ranges from 50–80 per

cent. of the mature endocarps, 50–75 per cent. of the viable individuals actually germinating. Germination normally requires twelve to eighteen months or longer, but bird-voided and wild pig-voided endocarps germinate in less time. Undisturbed drupes lying in sites not congenial to germination may remain dormant for eighteen to thirty-six months. Agents of dispersal are described, the " Bush-dove " being the most important.

5. The younger regeneration is briefly described.

6. The rate of growth in girth is extremely slow, figures being given for undisturbed forest; the height-increment of seedlings is also poor.

7. The principal mortality factors of the flowers, fruits, seedlings, and older stages are mentioned; *Fusarium* sp. attacking young seedlings and *Fomes applanatus* Gill. attacking adult boles are the most important, each being responsible for much damage.

8. The ecological importance of the species lies in its possessing a strong light-reducing reaction, a superficial root-system drawing strongly upon soil-moisture from the upper 18 inches, and a strong regenerating capacity.

9. An " aurea " and an " aurea-variegata " form are described briefly; the variety *concolor* Harv. is considered as not existing, but as being a confusion with *O. concolor* E. Mey. *O. macrocarpa* C. H. Wright (Zoutpansberg forests) is considered to be identical with *O. laurifolia* Lam.

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I. THE STRUCTURE AND LIFE-HISTORY OF THE SOUTH AFRICAN LAGAROSIPHONS.

By Vincent A. Wager, M.Sc.

(With Plates XVIII–XXIV.)

This investigation was undertaken with the idea of finding real specific differences, if any, between the South African species of Lagarosiphon, and to study some points in connection with the structure, morphology, physiology, and life-history of these and some other water plants.

I have to thank Professor C. E. Moss, of the University of the Witwatersrand, Johannesburg, for suggesting the investigation, and for his kindly help at all times. Most of the work was done in his department.

I. Generic Characters and Affinities of Lagarosiphon.

Lagarosiphon belongs to the family Hydrocharitaceae, and is closely allied to Elodea and Hydrilla. The distinctive characters of these three genera are as follows :—

*Lagarosiphon.**—Stems are elongated and branched. The leaves are crowded and alternate, sub-opposite or whorled ; linear or linear-lanceolate. The spathes are axillary, solitary, and unisexual. The male spathe is ovate, 2-fid at the apex, and many-flowered. Calyx 3 lobes, narrow. Corolla 3, ovate. Stamens 3 ; anthers ovate ; staminodes 2–3. Female spathe narrow, oblong, 1-flowered. Calyx and corolla similar to those of male. Ovary 1-celled, shortly rostrate, with 3 parietal placentas ; styles 3, erect, ovules many, orthotropous.

Elodea.†—Leaves whorled, with squamulae in their axils. Male flower has a double perianth ; androecium 9 stamens. Female as in Lagarosiphon.

Hydrilla.‡—Leaves verticillate. Male spathe 1-flowered ; perianth double ; stamens 3. Female has no staminodes. Otherwise as Lagarosiphon.

* Harvey in Hooker's Journ. Bot., iv, 230, t. 22 (1842).

† Willis, Flowering Plants and Ferns.

‡ Flora of Tropical Africa, vol. viii.

II. South African Species of Lagarosiphon.

A. *Lagarosiphon muscoides* Harvey, *loc. cit.*

(Figs. 1 and 2.)

Stem terete, up to 2 feet long, very much branched, very slender, average diameter 1·5 mm.

Leaves whorled or sub-whorled to alternate, linear, acute, 1-nerved, average length 10 mm., average breadth at widest part 1·5 mm., with 3 marginal rows of cells destitute of chlorophyll; teeth very acute, long, 55 on each side, on the average.

Squamulae lanceolate, 0·25 mm. long, and 0·1 mm. broad at the widest part near the base.

Flowers dioecious, regular, actinomorphic, enclosed in spathes.

Male spathe has up to 40 flowers in each spathe, axillary, solitary, sessile, obovate, maximum length 4·2 mm., maximum breadth 2 mm., with about 23 teeth on each side.

Male Flower.

Perianth 6 segments, polyphyllous, membranous, in 2 whorls; outer whorl larger, 3, ovoid, each segment 1 mm. long and 0·5 mm. broad; inner whorl smaller, 3 segments, elongated, each part narrower at the middle than at the ends, 1 mm. long, 0·33 mm. wide at the ends, 0·25 mm. wide at narrowest part.

Stamens 3; filaments long, rod-like, 1·66 mm. long; anthers elongated, at right angles to filaments.

Staminodes 3, erect, light purple in colour, 4·5 mm. long.

Female spathe elliptic, axillary, solitary, sessile, maximum length of spathe 4·5 mm., maximum breadth of spathe 1·5 mm.; teeth very long, acute, about 25 teeth on each side.

Female Flower (enclosed singly in Spathe).

Perianth in 2 whorls, colourless; outer whorl larger, each lobe obovate, 1·75 mm. long and 1·1 mm. broad; inner whorl smaller, each lobe elliptical, 1·5 mm. long and 0·9 mm. broad.

Perianth tube long, slender, thread-like, white, 0·2 mm. in diameter and from 1 cm. to 25 cm. long.

Staminodes 3, very small, blue, 0·3 mm. long.

Styles 3, adnate to inside of perianth tube.

Stigmas 6, dark purple in colour, 1·25 to 1·5 mm. long.

Ovary of 3 carpels, syncarpous, unilocular, inferior, with 3 parietal placentas.

Ovules numerous, orthotropous.

The following apparently different states of *Lagarosiphon muscoides* have been found in the neighbourhood of Johannesburg :—

(*a*) *Lagarosiphon muscoides* forma *typica* Wager.

This is the most common form found in all localities, and is the plant just described.

(*b*) *Lagarosiphon muscoides* forma *brevifolia* Wager.

This is a very delicate plant, and was collected at Birchleigh. The stem is much branched, and the leaves are spread out on it. The leaves are very short, being 5 to 6 mm. long. The teeth are the same shape as those of *L. muscoides*, and are 45 to 55 on each side. All other characters are like *L. muscoides*.

(*c*) *Lagarosiphon muscoides* forma *longifolia* Wager.

It is a much larger plant, and was collected at Benoni. The leaves are very crowded all along the stem, and are long, being 13 to 15 mm. in length. Each leaf has 65 to 75 teeth on each side.

The larger form, *L. muscoides* forma *longifolia*, was planted in a glass-sided aquarium, which was placed in a position under unsuitable conditions of light and temperature in the green-house. The plant after a time assumed a very different appearance, in that the new leaves were only about half the length of the old ones. After the plant had grown for some time the original part of the stem had long leaves, while the new part had short leaves. Accompanying this reduction in length of leaves was also a well-marked reduction in the number of teeth on each side.

The reverse experiment was also tried with *L. muscoides* forma *brevifolia*, grown in optimum conditions of light and temperature. The result was that the leaves of the newly grown part were very much longer than before, and there was also an increase in the number of teeth on each side.

Thus there are two different habitat states of the same species due to different external conditions.

The difference in length of leaf and number of teeth on each side in these two states raises a doubt as to whether the key given for the species of Lagarosiphon in the Flora of Tropical Africa is likely to be useful.

B. *Lagarosiphon major* Moss, comb. nov. ; *L. muscoides* var. *major* Ridley, in Journ. Linn. Soc., xxii, 233 (1886).

Stem 3 mm. in diameter.

Leaves average length 16 mm. ; breadth 2 mm. ; marginal rows of cells not destitute of chlorophyll ; teeth not so acute, average 60 on each side.

Squamulae elongate, tapering, 0·8 mm. long and 0·15 mm. broad at the base.

Flowers dioecious.

Male spathe has about 8 or 9 teeth on each side; length of spathe 5 mm., breadth 3 mm.; about 50 flowers in each spathe.

Male Flower.

Perianth: outer whorl segments are 1·25 mm. long and 0·66 mm. broad at broadest part; inner whorl segments are 1 mm. long and 0·35 mm. broad at narrowest part.

Stamens: filaments are 1·25 mm. long.

Staminodes are 2 mm. long.

Female spathe ovoid in shape; maximum length 5·5 mm. and maximum breadth 2·5 mm.; teeth are usually half as many on one side as on the other, and are usually about 12 and 6 in number.

Female Flower.

Perianth is of a pinkish tinge; outer whorl is elliptic and obovate, 1·75 mm. long and 1·1 mm. broad; inner whorl segments are 1·75 mm. long and 0·8 mm. broad.

Perianth tube up to 15 cm. long, with a diameter of 0·4 mm.

Staminodes 3, colourless, 0·4 mm. long.

Stigmas red, 1·5 mm. long.

In *Lagarosiphon major* there is very little variation, except occasionally in very good conditions, when the leaves are slightly larger and have more teeth. Specimens from districts as far apart as Belfast and Birchleigh were practically identical.

III. Morphology and Anatomy.

A. *Lagarosiphon muscoides.*

(Figs. 1 and 2.)

Leaves.—At the tip of the stem the leaves are in whorls and are very densely crowded, while lower down the stem they are more spread out and sub-whorled to alternate.

Each leaf has one vein, which extends along the centre from the base to the tip.

Along the edge of the leaf there is a band of hyaline cells, about three rows deep, and it is the outer row of this band in which the teeth are found. Each tooth consists of a long, narrow, pointed cell (fig. 5). The tip of the

leaf has two very much longer teeth, one on each side of the vein (fig. 3). It is doubtful if these leaves are leaves in the true sense, as there are no buds in their axils. Yet a flower-bud may be formed in the axil of any leaf.

The leaf consists of two layers of cells, the upper layer being smaller than the lower. Chloroplasts are found in cells of both layers.

Often a whitish, flaky deposit is formed on the upper surface of the leaf, but upon being touched it falls off. This deposit was found to be calcareous.

Squamulae (fig. 7).—There are two squamulae in the axil of each leaf. They are extremely small, being only about 0·25 mm. long by 0·1 mm. broad. They are lanceolate in shape, and, except around the edges, are two layers in thickness, and consist of large irregularly shaped, thin-walled, colourless cells.

Stem.—The growth in length of the stem is indefinite. It keeps on elongating, while conditions of growth are suitable.

The conductive tissue is very poorly developed, and, as support is given by the water, there is no sclerenchyma (fig. 8).

From the outside, in order, a section shows—

1. A single epidermal layer of undifferentiated cells of irregular shapes. No cuticle is present.

2. One layer of similar undifferentiated sub-epidermal cells.

3. The cortex, consisting of well-marked aerenchyma, the spaces being separated by single layers of cells.

4. The axial strand. No endodermis and pericycle are distinguishable. The axial strand is small, being about one-fifth of the diameter of the stem, and consists of a mass of thin-walled, irregularly shaped small cells of leptome tissue. In the centre there is a lysigenous intercellular space bounded by a layer of slightly larger cells. Several smaller cavities also lie near the periphery of the leptome tissue.

Roots.—The plant is attached to the substratum by numerous, thin, thread-like roots. Many adventitious roots are often formed on the under side of the stem under certain conditions.

The structure of one of these adventitious roots in cross-section is very similar to that of the stem, and shows the following :—

1. An outer piliferous layer of irregular, hardly differentiated, thin-walled cells.

2. A cortex of more or less rounded cells with fairly large intercellular spaces.

3. The axial strand about one-seventh the diameter of the section. Otherwise it is similar in structure to that of the stem.

Flower.—The plants are dioecious.

Male Flower and Spathe.—Each spathe consists of two leaf-like parts,

united at the sides by a band of cells three to four rows deep. This band of cells is evidently a dehiscing layer, for when the spathe opens at the top, to allow the flowers to get through, it breaks away from each side of the two parts of the spathe for a short distance from the top, thus leaving them free and open (see in figs. 11 and 12). There may be one, two, or three spathes at each whorl of leaves.

A very young spathe contains only a short-growing axis (*cf.* fig. 11), resembling that found at the tip of a vegetative stem. It is about 1 mm. long, and has the appearance of a pillar, much thickened at the base, and has over most of its surface little swellings. This short axis is a rudimentary inflorescence, most of the small swellings later forming flowers. At a later stage the spathe is full of small flower-buds, each attached to the small axis which has now lost its form (fig. 12).

Each flower-bud has a stalk about twice its own length. When the bud is fairly developed it breaks away from the tip of its stalk and rises to the surface of the water. The bud then floats for a short time, until fully mature, when the six petals suddenly spring backwards, the three larger ovoid ones fitting into the three smaller ones. Each of the smaller petals is wider at the ends than at the centre (fig. 10). The flower thus becomes a bell-shaped structure, which floats easily and steadily on the surface of the water, and it is impossible for it to be blown or knocked over on its side.

The stamens and staminodes which were tightly curled up in the bud slowly uncurl and stretch out, until in about half an hour the flower has its final shape (fig. 10). The filaments of the stamens stretch out parallel to the surface of the water, while the anthers are turned downwards at right angles (fig. 10). Each anther consists of two lobes, joined together at the top. Each part has two longitudinal pollen sacs, each sac containing four pollen grains, so that each anther has the small number of sixteen pollen grains, and thus each male flower produces only forty-eight pollen grains.

The staminodes are much longer than the stamens, and are of a delicate purple colour. They stand erect, each bulging outwards slightly and bending in at the top, where the three are joined together. The surface of the upper two-thirds of each staminode is very papillate, caused by each outer cell forming an elongated projection. They stand above the other parts of the flower, and, acting as a kind of sail, the little flower is blown about the surface of the water. Usually a very large number of these tiny pollen-bearing flowers float around together and form downy patches on the water.

The pollen grains are large, being about 0·13 mm. in diameter.

Female Flower and Spathe.—The female spathe is similar to that of the male, having a band of cells along each side (fig. 13). A very young spathe contains a growing axis or rudimentary inflorescence, but only one of the

lowest buds develops into a female flower. This appears as a small inferior ovary surmounted by a short, thick perianth-tube, with the rounded, closed flower-head on top (fig. 13). As the spathe enlarges, the perianth-tube rapidly increases in length, and forces its way out through the top of the spathe, where the row of cells at each side has broken away (fig. 15).

As the head of the flower breaks through the spathe, a bubble of gas very slowly begins to form at the top of the perianth, and gradually increases in size, until, becoming too large and buoyant, it breaks away. Another bubble slowly begins to form in its place. Meanwhile the perianth-tube continues to grow very rapidly, while bubbles are continually being formed. As pollination can only take place above the water, and as the perianth-tube is very delicate and thread-like, having no mechanical tissue whatsoever, this device enables the flower to reach the surface. Thus the vertical direction of growth is ensured.

In bright weather, bubbles are continually being formed, until the flower reaches the surface, and in this way the perianth-tube may reach the surprising length of about 25 cm., depending upon the depth in the water of the female spathe. This appears to be the maximum length attainable, for, if the surface is not reached by then, gas is no longer given off, and the flower turns brown and slowly sinks.

In dull weather, or under conditions where it is not subjected to bright light, the perianth-tube does not grow very much, and the flower seldom reaches the surface. At the same time, no bubbles are given off, so that bright sunlight is evidently necessary for the formation of the gas.

If the surface is reached when the perianth-tube is only a few centimetres long, it often keeps on growing and curling in the water, probably to provide for a sudden rise in the level of the water. The flower-head usually opens when the perianth-tube is about 6 cms. long.

The perianth segments are colourless, thin, and membranous, and they have a non-wettable surface, for they do not become wet upon being submerged.

The staminodes are small and rod-like, and can only be distinguished after close examination. They are of a blue colour, and have a very papillate surface similar to that of the male staminodes, but the projecting papillae are more numerous and much smaller.

There are three styles, each being a continuation of a placenta in the ovary, and they are embedded in, and adnate to, the tissue of the perianth-tube (fig. 9). Each style divides into two immediately upon leaving the perianth-tube, so that there are six elongated stigmas. Each stigma is of a dark purplish colour, and has a very papillate surface, the papillae being in this case large.

The Structure of the Perianth-tube.—It does not consist, as one would expect, of a hollow tube with three loose, thread-like stigmas inside. The tissue of the styles is fused with the tissue of the perianth-tube, each in a triangular patch (fig. 9). A cross-section of the perianth-tube shows the following :—

1. A triangular cavity in the centre.
2. The stylar tissue as a semicircular patch of cells on each side of the cavity.
3. Thin-walled cortical tissue surrounding the stylar tissue.
4. Epidermis of a single layer of large thin-walled cells. No cuticle is present.

The dormant inflorescence or growing axis in the female spathe, having given rise to the single female flower, rarely develops further when the plants are growing in good conditions. Often, however, if the water is too deep, or if for some other reason the flower is not pollinated, the ovary dies, and then the axis grows out to form an ordinary leafy branch.

After fertilisation the ovary enlarges, and is more or less triangular in shape, with the seeds attached to the three placentas at the rounded corners. As the seeds enlarge, the fruit elongates greatly. When the seeds ripen they break away from the placentas, and, instead of bulging the walls of the fruit outwards, they are pushed up the elongated portion of the fruit, one behind the other. Thus the fruit projects far beyond the spathe (fig. 17).

B. *Lagarosiphon major.*

This plant is closely allied to *L. muscoides* in anatomy and morphology. It differs, however, in a few small details. *L. major* is a much larger, stronger, and more rigid plant.

In the leaves, the cells contain chloroplasts right up to the outside row, so that there is no hyaline band (fig. 4).

The teeth on the leaves and spathes have a different shape : they are short and blunt (fig. 6).

On the male spathe there are only a few small teeth on each side—about eight or nine. The female spathe also has few teeth ; usually they are twice as numerous on one side than on the other (figs. 11, 14, 16).

The growing axis or rudimentary inflorescence is much shorter and stouter than is the case in *L. muscoides*.

The perianth-tube is thicker, being 0·4 mm. in diameter, and never grows to such a length. At a maximum of about 15 cm. it begins to die.

The pistillate flower-buds always open immediately upon leaving the spathe.

In the staminate flower the filaments of the stamens are slightly shorter

and stouter, and the staminodes less than half as long as those of *L. muscoides*, being only 2 mm. long.

The fruit also shows a slight difference, in that, upon the ripening of the seeds, it increases in girth, but only slightly in length.

IV. Pollination.

The pistillate flower of both species of *Lagarosiphon*, on reaching the surface, floats with its perianth-lobes spread out like a saucer.

When the male flower opens, the pollen is seldom shed, except by contact with some other body, but remains adhering to the edges of the open anthers. The filaments of the stamens are parallel to the surface of the water, and are slightly longer than the bent perianth segments of the pistillate flower. The stamens stand above the surface of the water at the same height as the stigmas. When, therefore, a staminate and pistillate flower come close together, the anthers are in the correct position for making contact with the stigmas. Owing to the surface tension of the water, a staminate flower, happening to be in the vicinity of a stationary, anchored, pistillate flower, will move towards it and come to rest with the two perianths touching. Thus, with any slight movement of air or water a stamen touches a stigma and deposits a few pollen grains on the papillate surface.

Pollen grains are often seen, upon examining the stigmas of a flower under the microscope, caught in between a few papillae. In such a case a pollen-tube, which is very thin, can often be clearly seen projecting some little distance before entering the tissue of the stigma. In order to bring about fertilisation, these thin pollen tubes have thus to pass down the great length of the perianth-tube, which may sometimes be as much as 25 cm.

V. Germination.

When the seeds are ripe, the fruit becomes filled with mucilage, which expands rapidly and causes the fruit to burst open irregularly, thus liberating the seeds. These show variations in size and shape, some being longer and broader than others. At the basal end there is a knob where the seed was joined to the placenta, and the other extremity is pointed (fig. 18). The seeds average about nine to each fruit, and are about 2·5 mm. long. When they are set free they rise to the top and float on the surface for some time. Thus dissemination is ensured, and the seeds may be carried considerable distances. After a time they sink.

Some seeds were collected at the beginning of autumn (April), and many attempts were made to germinate them, but without success. In the

middle of October, however, they slowly began to germinate at the same time as those which had remained submerged since April.

The seed bursts open at the pointed end, and a short, white, cylindrical body, blunt at one end and tapering at the other, comes out, leaving the empty seed-case behind. The blunt portion is the hypocotyl, while the tapering portion is the cotyledon. The young plant elongates rapidly; and a circlet of small projections, the beginnings of the root hairs, spring from the base of the hypocotyl and surround the tiny tip of the radicle (fig. 19).

The hypocotyl and cotyledon continue to elongate, the root hairs becoming a tangled mass. The radicle grows out in the centre, and elongates rapidly. At the junction of cotyledon and hypocotyl a swelling appears, and later, through this swelling, the young plumule pushes its way, surrounded by a whorl of tiny leaves, and the young plant is established (fig. 20).

If, at this stage, the water is slowly allowed to just dry up, and the plant then again submerged, it appears to be dead, the cotyledon, hypocotyl, and radicle turning brown: often the tiny bud revives, and soon a new set of leaves appears, and later a strong plant may be formed.

The empty seed-coat is very striking. It is in the form of a hollow cylinder, and consists of a single layer of cells (fig. 20).

VI. Physiology.

Gas given off at the Flowers.—Many flower-heads, each with its bubble of gas, were led under an inverted graduated test-tube full of water. Gas was continually given off and collected in the top of the test-tube.

The average composition of the gas was:

Oxygen	35 per cent.
Nitrogen	65 per cent.

The oxygen constituent varied from 34 to 36 per cent.

This gas evidently serves for the purely mechanical purpose of raising the flowers to the surface of the water, but the means by which the gas is produced is difficult of explanation. If it is a secretion by the plant of the dissolved air in the water, then the direct rays of the sun, as described previously, are a determining factor in such secretion. The nitrogen constituent of this gas appears to be the stumbling-block to any explanation which could otherwise possibly be given, as being due to any chemical processes taking place in the plant. In this connection it has been mentioned that the perianth-tube is never green, but white.

The gas reaches the top of the flower through the small, triangular passage in the perianth-tube. The perianth-lobes are all arranged around the top of this small central passage, which reaches from the perianth to the ovary. A piece of the perianth-tube, about 2 inches long, was cut off and examined under the microscope. There was a long, thin bubble of air left in the passage. When the perianth-tube was touched at one end, the contained air moved towards the other end, and, in fact, could be made to move backwards and forwards with the greatest ease and rapidity, although the diameter of the passage is not greater than 0·1 mm.

Gas is also given off after the flowers reach the surface, as was shown in the test-tube, for the water-level continued to fall.

If the perianth-tube is cut across just below the flower top, while a bubble is being formed, a stream of minute bubbles is given off in slow succession at the cut end. If it is again cut off some distance further down, the bubbles are still given off for some time, but more slowly. One would expect that the passage in the perianth-tube would be connected through the base of the ovary to the aerenchyma in the stem. Many series of microtome sections, however, both transversely and longitudinally, of *L. muscoides* and *L. major* showed in every case no trace of any passage between the base of the ovary and the stem. The basal tissue consists of parenchymatous cells showing only small intercellular spaces.

II. NOTES AND DESCRIPTIONS OF A FEW UNCOMMON WATER PLANTS.

1. *Ottelia* sp., cf. *O. ulvaefolia* (Planchon) Walpers, Ann., iii, 510 (1852–3).

This plant was collected on Mr. Willson's farm, Blackhills, at Gravelotte, Transvaal, in January 1925.

The plants were found growing in natural " pans," which only contain water for a few months during the rainy season, and which were dry for the remainder of the year.

Habit : aquatic herb, which lives totally submerged in fairly shallow water. The flower only projects (fig. 21).

Roots, fibrous.

Stem is the very short portion above the root, from which the leaves spring.

Leaves are crowded, totally submerged, apparently radical, up to 23 cm. long, 4·5 cm. broad at the broadest part. The lamina is lanceolate, tapering slowly towards the base, sub-amplexicaul, sessile, undulate, thin, and membranous, parallel-veined, and with a thickened mid-rib.

Flowers are monoclinous.

Scape varies in length according to conditions, but the maximum length is about 23 cm., and it is triangular in cross-section.

Spathe consists of two bracts or bracteoles, fused at the edges to form a compressed saccate covering, filled with water. It is 2 to 2·5 cm. long and 1·2 cm. wide at widest part, and is bidentate at the mouth. It is green and membranous, and has neither teeth nor wings on its sides.

Pedicel is short.

Perianth-Tube.—Between the ovary and the perianth segments there is a short perianth-tube about 2·5 cm. long. This is partly enclosed by the spathe and partly projects beyond. The scape of the flower grows just long enough to allow the perianth segments to project above the water.

Sepals are 3, green, oblong-linear, superior, 0·75 to 1 cm. long.

Petals are 3, yellow, much larger than the calyx lobes, being 2·5 to 3 cm. long. They are obovate, thin, and membranous.

Androecium consists of 6 stamens.

Cynoecium consists of 6 carpels, syncarpous, inferior ;

ovary is oblong and rostrate ;

styles are 6 in number, enclosed in the short perianth-tube.

stigmas are 6, each is shorter than the stamens and thicker than the filaments, and is shortly bifid at the top ;

ovules numerous (about 50). Placentation is parietal.

The flower only lasts one day after opening above the water. Then the stigmas decompose into a sticky jelly mass, and the petals wither. The calyx and perianth-tube, however, do not wither, but are persistent. Immediately upon withering, the flower is slowly drawn beneath the water by the scape, which begins to curl and bend to such an extent that after a few days the spathe is almost drawn to the bottom of the water. Here the ovary begins to expand until the fruit nearly fills the spathe. After a time it becomes full of mucilage, and bursts, and the seeds are scattered through the water.

The plant apparently does not depend upon cross-pollination, for when it was growing in an aquarium a single flower appeared long before any others. After lasting a day, it was drawn below and the fruit matured, later to burst, about fifty seeds being found.

The seeds are small and cylindrical, and very similar in shape to those of Lagarosiphon, except that each has a coating of fine, white hairs.

2. *Zannichelli pedicellata* Fries., from Glen, O.F.S.

This is a small plant, like fine grass in general appearance, which occurs commonly around Bloemfontein. It grows in shallow water on the banks

of the Modder River, and also in dams, pools, etc. It grows completely submerged, flowers as well, on soft mud.

Stem is a creeping underground stem, with adventitious roots at all the nodes. The upright stems are short, thin, cylindrical, usually not more than 15 cm. long.

Leaves are 1, 2, or 3 together at a node. Each is 2 to 5 cm. long, and is thin, cylindrical, tapering but slightly flattened towards the apex.

Sheath.—One sheath occurs at each node, and is of a brownish colour. It is 3 mm. long by 1 mm. broad.

Squamulae are small and leaf-like, with elongated thin cells. Each is about 0·8 mm. long.

Flowers.—A staminate and pistillate flower may occur side by side at each node.

Staminate flower consists of 1 stamen (fig. 22). It has no perianth. The filament is about 3 mm. long and 0·2 mm. broad, and is rod-like. The anther is sagittate in shape, and has 2 anther lobes, 1·2 mm. long by 0·6 mm. wide. Pollen grains are present in large numbers in each anther lobe. They are very small, spherical, 0·03 mm. in diameter, and have a very thin extine.

Pistillate Flower.—The perianth is a short tube, very thin and membranous, and surrounds the two, sometimes three, and rarely four, separate carpels which are joined together at the base. Each carpel is 0·4 mm. long, and contains one basal ovule. The style is 0·4 mm. long, and the stigma is the same length. The basal portion of the stigma is funnel-shaped, one side of the funnel being very much enlarged, flat, and obovate (fig. 23). The fruit is banana-shaped, and is 2 mm. long, excluding the style and basal portion of the stigma, which are persistent. The outer convex side has 3 to 5 slight projections or knobs (fig. 24). The seed is cylindrical, curved, nearly 2 mm. long, and white.

The staminate and pistillate flowers occur at the tip of the stem, and usually grow up side by side enclosed in the sheath at the node. The male grows very rapidly, and is mature before the female. When the anthers burst, the small pollen grains, of which there are immense numbers in each anther, are liberated into the water. The stigma is large and spoon-shaped, for the purpose of catching some of these water-borne pollen grains.

Some time after the seed is mature it drops off the plant still encased in the fruit, which has the peculiar-looking knobs on one side. Germination may take place a short time after the fruit has fallen to the bottom, or the following season.

The plant grows very rapidly, small ponds soon becoming full of it.

3. ***Resting Buds of Utricularia stellaris*** Linn., fil. suppl., pl. 86 (1781).

Towards the end of the season, *Utricularia stellaris* forms resting buds which may carry the plant over until the following spring. This is in addition to seed production.

A mature bud is about 0·6 cm. in diameter, and consists of very closely packed leaves, each leaf having numerous clusters of spikes in patches.

There are two methods by which the bud may develop:

(*a*) The main axis of the bud elongates and grows, new leaves and bladders being formed at the tip of the newly growing part. Growth is rapid, side branches are formed, and soon the plant is well established in its floating habit.

(*b*) Often the bud becomes broken, so that the leaves become scattered. Each leaf then begins to form a new plant. In the axils of the segments of the compound leaf minute buds are formed. One or more of these buds rapidly grows and elongates until a small branch is formed, which, under normal conditions, soon forms a vigorous plant (fig. 25).

A resting bud is not damaged by exposure to drought, even if this is rather prolonged. A plant of *Utricularia stellaris*, with numerous buds, was pressed, dried, mounted, and placed in the herbarium. Six months later a couple of buds were removed and put into an aquarium. They slowly swelled up, and soon began to develop by both methods described above, and later formed healthy plants (fig. 26).

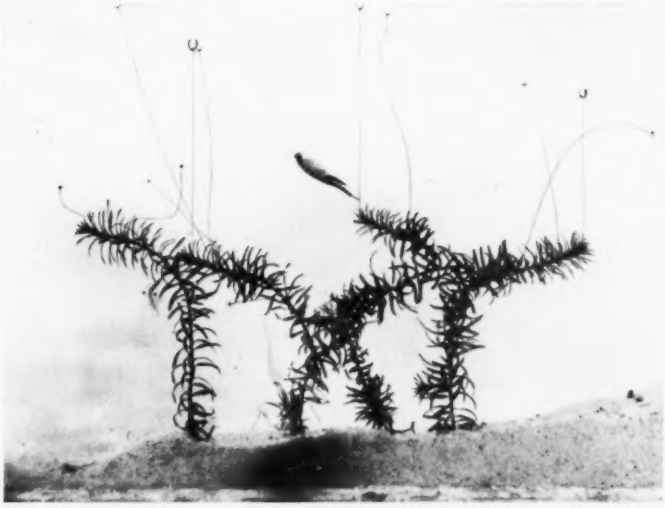
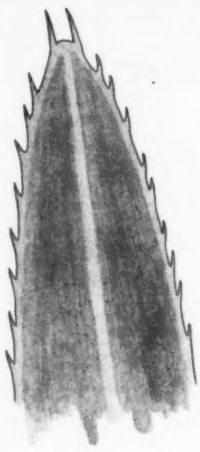


FIG. 1.—*Lagarosiphon muscoides*: pistillate plant, showing flowers buoyed up by bubbles. (The Crustacean is a species of *Branchipus*.)

FIG. 2.—*Lagarosiphon muscoides*: staminate plant, showing spathes in axils of leaves. (The tadpole is *Cassina senegalensis*.)

Photos by V. A. Wager. *Neill & Co., Ltd.*



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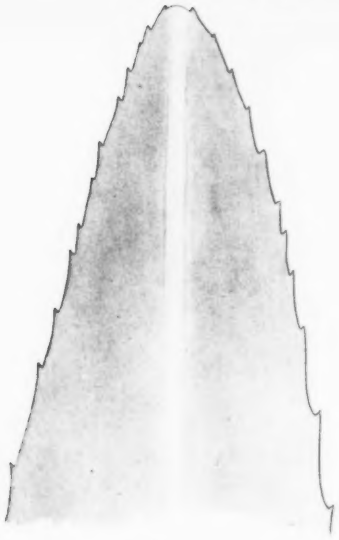

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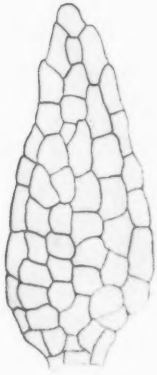

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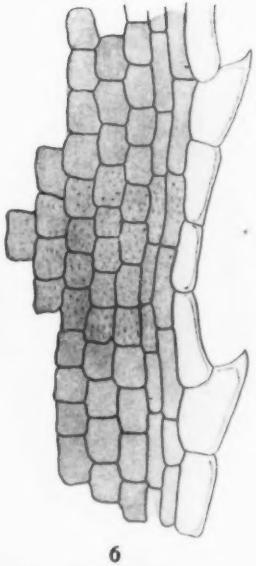

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FIG. 3.—*Lagarosiphon muscoides*: apex of leaf ($\frac{1}{4}$ of total length). ×25 (diam.).
FIG. 4.—*Lagarosiphon major*: apex of leaf ($\frac{1}{4}$ of total length). ×25.
FIG. 5.—*Lagarosiphon muscoides*: margin of portion of leaf. ×150.
FIG. 6.—*Lagarosiphon major*: margin of portion of leaf. ×150.
FIG. 7.—*Lagarosiphon muscoides*: squamula. ×200.

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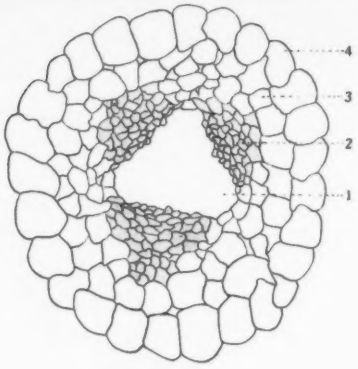

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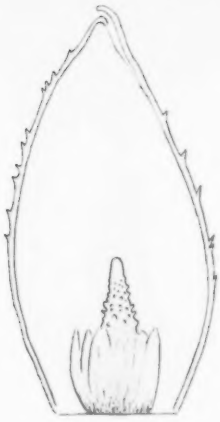

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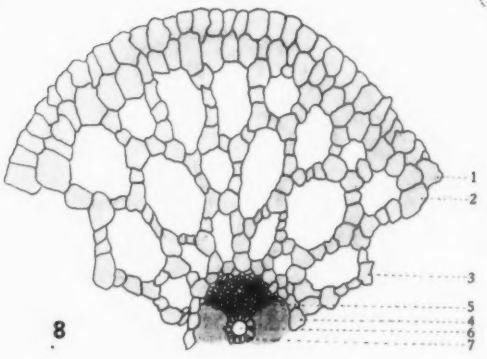

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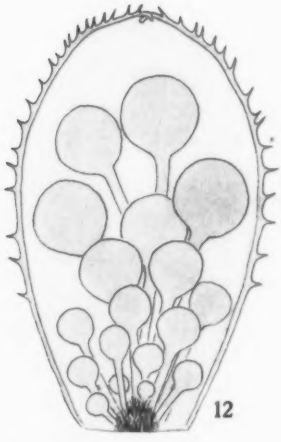

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FIG. 8.—*Lagarosiphon muscoides*: cross-section of stem. ×65 (diam.).
1, epidermal layer; 2, sub-epidermal layer; 3, aerenchyma; 4, inner layer of cortex; 5, leptome tissue; 6, lysigenous space; 7, layer of cells bounding the lysigenous space.

FIG. 9.—*Lagarosiphon muscoides*: transverse section of perianth-tube. ×250.
1, air passage; 2, stylar tissue; 3, cortex; 4, epidermis.

FIG. 10.—*Lagarosiphon muscoides*: staminate flower. ×12·5.

FIG. 11.—*Lagarosiphon major*: very young staminate spathe containing rudimentary inflorescence axis. ×20.

FIG. 12.—*Lagarosiphon muscoides*: staminate spathe. ×15.

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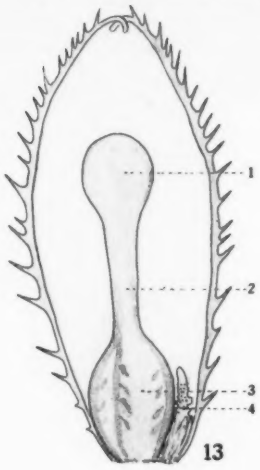

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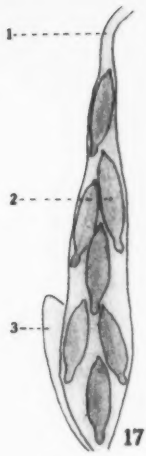

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Fig. 13.—*Lagarosiphon muscoides*: young pistillate spathe. ×20 (diam.).
1, flower-head; 2, perianth-tube; 3, ovary; 4, rudimentary inflorescence.

Fig. 14.—*Lagarosiphon major*: young pistillate spathe. ×20.

Fig. 15.—*Lagarosiphon muscoides*: old pistillate spathe. ×22·5.

Fig. 16.—*Lagarosiphon major*: old pistillate spathe. ×30.

Fig. 17.—*Lagarosiphon muscoides*: mature fruit. ×5.
1, perianth-tube; 2, seeds; 3, remains of spathe.

Fig. 18.—*Lagarosiphon muscoides*: seed. ×17·5.

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Photo by V. A. Wager.

FIG. 21.—*Ottelia* sp., cf. *O. ulvaefolia.*

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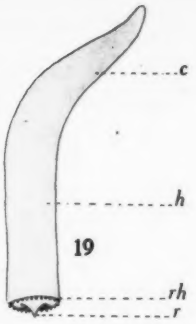

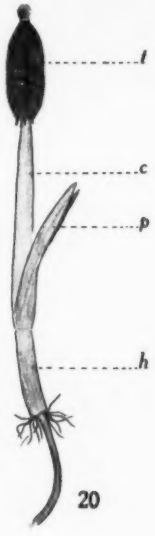

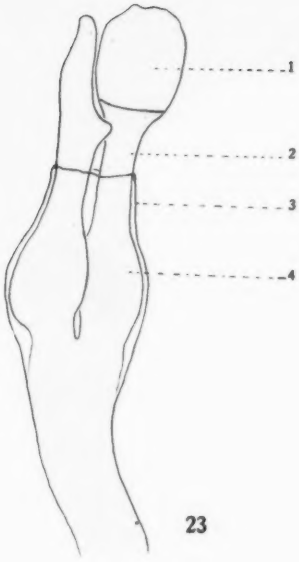

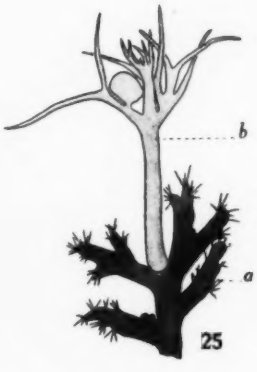

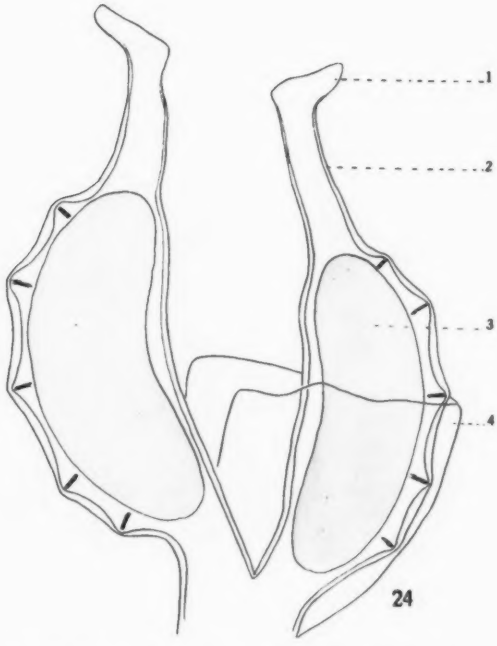

Fig. 19.—*Lagarosiphon muscoides*: young seedling. ×15 (diam.).
c=cotyledon; *h*=hypocotyl; *rh*=ring of root hairs; *r*=radicle.

Fig. 20.—*Lagarosiphon muscoides*: older seedling. ×7·5.
t=empty testa; *c*=cotyledon; *p*=plumule leaves; *h*=hypocotyl.

Fig. 22.—*Zannichellia pedicellata*: staminate flower. ×25.

Fig. 23.—*Zannichellia pedicellata*: pistillate flower. ×45.
1, stigma; 2, style; 3, perianth; 4, ovary.

Fig. 24.—*Zannichellia pedicellata*: ripe fruits. ×25.
1 and 2, persistent style and stigma; 3, seed; 4, remains of perianth.

Fig. 25.—*Utricularia stellaris*. ×5.
a, old leaf of resting bud; *b*, new shoot.

FIG. 26.—*Utricularia stellaris* showing resting buds. The buds are either borne terminally or on special stalks.

Photo by V. A. Wager. *Neill & Co., Ltd.*

THE PERIVISCERAL FLUID OF *CUCUMARIA FRAUENFELDI*.

By J. VAN DER LINGEN and LANCELOT HOGBEN.

(From the Department of Zoology, University of Cape Town.)

The Holothurian *Cucumaria frauenfeldi* (Ludwig) is a common object of the littoral fauna of the Cape Peninsula, abundant in rock pools at Sea Point. We are indebted to Dr. Barnard for the identification of the species. In examining specimens it was noticed by one of us that on cutting through the integument a red fluid exudes copiously from the body cavity. The fluid was collected in sufficient quantity to examine spectroscopically, after a preliminary test by shaking *in vacuo*, to ascertain whether it contained a respiratory pigment or not. On evacuating a tube containing 5 c.c. of fluid, the colour changed from scarlet to a port-wine red, which reverted to bright scarlet after readmitting air and shaking. This indicated that the pigment was a reversibly oxidisable one, almost certainly of the haemoglobin series, common to the blood of vertebrates, most annelids, and a few isolated representatives of other phyla, such as Chironomus (an insect larva), Planorbis (a gastropod), and Cerebratulus (a nemertine). This conclusion was confirmed by spectroscopic examination of the pigment and of derivatives prepared from it by us.

Before proceeding, however, to remark upon the characteristics of the spectrum of this haemoglobin, there is one very noteworthy circumstance that compels attention. The presence of haemoglobin in a Holothurian is in itself an interesting occurrence, since the Echinoderms as a group lack a well-developed muscular circulatory system, though a haemoglobin-like pigment, *actinochrome*, has been reported in certain starfishes. In *C. frauenfeldi* about 2 c.c. of fluid obtained from individuals an inch or an inch and a half in length had to be diluted a hundred times for spectroscopic examination. In most cases the exudate, when first shed, was purplish, changing to scarlet on standing, thus indicating that conditions exist in the animal itself to ensure the reduction of the oxidant. This implies that the holothurian haemoglobin is physiologically a respiratory pigment. But the most arresting feature of the fluid lies in the fact that the haemoglobin is not dissolved homogeneously in the exudate but contained

in nucleated cells which, like the erythrocytes of vertebrate blood, are the exclusive carriers of the respiratory pigment. Within a minute after shedding, these cells agglutinate, so that the red matter no longer appears diffuse but is seen to be concentrated in flocculent masses lying in a clear fluid. By shaking they are temporarily dispersed. These erythrocytes in shape are oval, slightly biconvex discs, and in size approximately 30 μ along the longest axis.

As regards the identity of the pigment, spectroscopic examination shows that it is not precisely identical with human haemoglobin or with that of the annelid Arenicola. A reduced haemoglobin was obtained with ammonium sulphide, and the carboxy derivative was prepared in the usual way. A methaemoglobin was not obtained by addition of solid potassium ferricyanide, though, on allowing the blood to stand after addition of chloroform as a preservative, a brownish tint appeared. The spectrum of this pigment, however, did not prove to be that of a methaemoglobin. Haematins could not be obtained by the usual procedure, neither were we successful in preparing a haemochromogen.

The oxyhaemoglobin showed bands in the green, the middle of which were at 579·0 $\mu\mu$ and 542·7 $\mu\mu$ respectively. The middle point of the green band for the reduced haemoglobin was 558 $\mu\mu$. The α and β bands of the carboxy-derivative had their mid points at 573·5 $\mu\mu$ and 538·3 $\mu\mu$ respectively. Thus the haemoglobin of Cucumaria more closely resembles the haemoglobin of the mammal than that of Arenicola.

THE AFRICAN GENERA AND SPECIES OF RESTIONACEAE.

By Neville S. Pillans.

Flowers dioecious, rarely monoecious or very rarely hermaphrodite. Perianth glumaceous, usually of 6 segments in 2 series, occasionally of less, rarely absent; segments all similar or the inner and outer series dissimilar; outer lateral segments frequently conduplicate and more or less carinate on the median nerve; inner segments usually rounded on the outer side. Stamens 3, opposite the inner perianth-segments; filaments free, usually very slender, occasionally ligulate; anthers dorsified, 1-celled, dehiscing by a longitudinal slit. Rudimentary ovary in the male flower with 2 or 3 imperfectly developed styles or absent. Female flower: staminodes 2 or 3, short, filiform, with or without rudimentary anthers, opposite the inner perianth-segments or absent. Ovary superior, free, 1–3-celled, with a solitary pendulous ovule in each cell; styles 1–3, usually slender, often thickened at base, usually adjacent, free or more or less connate from the base upwards, occasionally isolated, stigmatic on the inner side from or shortly above the base to the apex. Fruit a 2-, 3-, or, by abortion, 1-seeded capsule or a nut; seeds rotundate or elliptic, smooth, striate, or tubercled.

Perennial rush- or sedge-like herbs, with a tufted or creeping rootstock densely covered with scaly sheaths; stems erect or rarely reclining at base, slender or rigid, terete, compressed or quadrate, solid or fistular, straight or occasionally flexuose, simple or branched, with a leaf-sheath at each node; leaf-sheaths persistent or deciduous, usually closely convolute and tightly clasping the stem, occasionally loose and erect-spreading, with the margins free to the base, rarely produced at the apex into a linear leaf-like mucro; inflorescence spike-like or branched, alike or different in the sexes; spikelets usually many, often solitary, 1-, few-, or many-flowered, each usually with a sheath-like spathe at the base or accompanied by a spathella when in a panicled inflorescence; bracts usually imbricate in compact spikelets, persistent, mostly fertile in male spikelets, usually longer than and obscuring the perianth.

In habit and inflorescence the Restiaceae much resemble the Cyperaceae, and in the perianth there is an alliance with the Juncaceae, but they are chiefly distinguished from both by the pendulous ovules and seeds: also,

from the Cyperaceae they may be readily known by their leaf-sheaths having margins free to the base, not connate as in that family.

Throughout the present work, unless otherwise specified, the stems described are fertile; the leaf-sheaths described are upon the middle portion of the stem; the bracts described are in the middle part of the spikelet, and the measurements of length are from the base to the apex of the median nerve whether or not excurrent in a mucro; the shape of the perianth is the outline which it exhibits during the flowering period, and the measurements of length do not include the stipe; the keys to the species are based on characters in the female plants which, on the whole, possess much more reliable characters than are found in the male. The characters used in the keys and descriptions are taken from dried specimens. This may be borne in mind when dealing with living plants which do not always show all those characters, particularly in the cuticle of the stem, that are obvious in dried material.

During the preparation of this monograph I have been able to examine close on 4000 sheets of herbarium specimens. It is with much pleasure that I acknowledge my great obligations to Dr. A. W. Hill, F.R.S., Director of the Royal Botanic Gardens, Kew, for the privilege of using the Kew Herbarium and Library, and also for his very generous assistance in procuring the loan of specimens from institutions in Oxford, Cambridge, Dublin, Paris, Berlin, Upsala, and Stockholm. To those persons who granted the loans I wish to express my appreciation. Here I must also acknowledge the very helpful assistance given to me by Mr. A. D. Cotton, F.L.S., Keeper of the Kew Herbarium and Library, which greatly facilitated the carrying out of my researches at Kew. My thanks are due to Dr. A. B. Rendle, F.R.S., Keeper of the Department of Botany, British Museum, for permitting my examination of the collection in the Museum. I have also to record with gratitude the permission given me by the late Dr. B. D. Jackson, Secretary of the Linnean Society and Keeper of the Linnean Collections, to examine plants in Linne's herbarium.

In South Africa about 1500 sheets of dried specimens were received on loan for the purpose of this work. To the late Dr. L. Peringuey, former Director of the South African Museum, Cape Town, I am indebted for an extensive use of the collection at that institution. For the loan of dried specimens my thanks are due particularly to Dr. I. B. Pole Evans, C.M.G., Chief of the Division of Botany, Pretoria, to Dr. S. Schönland, Grahamstown, and to Dr. R. Marloth, Cape Town. Among those who have contributed living and dried plants, my thanks are due especially to Dr. J. Muir, Riversdale, to Miss A. V. Duthie, University of Stellenbosch, and to Mr. H. G. Fourcade, Witte Els Bosch, Humansdorp Division.

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TRIBE 1, RESTIOIDEAE, ovary 3- or, by abortion, 2- or 1-celled; fruit dehiscent.

Sheaths of the stem persistent; inner segments of the male and female perianth not or scarcely longer than the outer . . . . . i, RESTIO.

Sheaths of the stem deciduous or if persistent then the inner segments of the male and female perianth are distinctly longer than the outer . . ii, CHONDROPETALUM.

TRIBE 2, WILLDENOWIEAE, ovary 1-celled; fruit indehiscent.

Styles 3:

Female spikelets without empty bracts at the base (the spathellae are occasionally bract-like) . . . . . iii, ELEGIA.

Female spikelets with 1 or more empty bracts at the base:

Flowering stems branched or rarely simple; male spikelets erect, mostly ovate or oblong . . . . . iv, LEPTOCARPUS.

Flowering stems simple; male spikelets usually cernuous, mostly turbinate or suborbicular . . . . . vi, STABEROHA.

Styles 2:

Flowers hermaphrodite . . . . . xii, PHYLLOCOMOS.

Flowers dioecious:

Female spikelets without an empty bract at the base; female flowers neither in compact spikelets nor hidden by imbricate bracts (in Elegia the entire spikelets are often hidden by the spathes):

Male and female inflorescences each with a solitary spathe; spikelets solitary and terminal on the main stems or on short lateral branchlets, xi, ANTHOCHORTUS.

Male and female inflorescences each with more than 1 spathe; spikelets several or many in panicled or spicate cymes. . . . . iii, ELEGIA.

Female spikelets with 1 or more empty bracts at the base; female flowers hidden by imbricate bracts in compact spikelets:

Female spikelets 6- or more-flowered; flowers much compressed . vi, STABEROHA.

Female spikelets with 1, 2, or several flowers (not exceeding 5); female flowers obtusely trigonous, terete or slightly compressed:

Female spikelets with 2–5 fertile flowers, rarely, by abortion (in 1 species), with 1 fertile flower; ovary not tubercled; fruit compressed, terete or subterete, on its adaxial side flattened or with a longitudinal depression, ix, CANNOMOIS.

Female spikelets with 1 fertile flower, rarely (in one species) with 2 fertile flowers but then with the ovary tubercled on its upper parts; fruit terete:

Male flowers produced in racemes, panicles, or lax spikelets, perianth-segments of the male flowers resembling the bracts, not imbricate, x, WILLDENOWIA.

Male flowers produced in compact or rarely lax spikelets; perianth-segments of the male flowers not resembling the bracts, usually imbricate:

Stems repeatedly branched . . . . . vii, HYPOLAENA.

Stems simple . . . . . viii, HYPODISCUS.

Style solitary . . . . . v, THAMNOCHORTUS.

Tribe 1. RESTIOIDEAE.

I, RESTIO, *Linn., Syst. Nat.*, ed. 12, tom. 2, p. 735, addenda (1767); *Linn., Syst. Veg.*, ed. 13, p. 737 (1774); *Rottb., Program.*, 9 (1772); *ejusd. Descr. et Icon.*, 2 (1773); *Thunb., Diss. Rest.*, 5 (1788); *Linn., Syst. Veg.*, ed. 14, p. 881 (1784); *Thunb. in Usteri, Delect.*, i, 39 (1790); *Linn., Syst. Veg.*, ed. 15, p. 923 (1797); *Poir. in Lam., Encycl. Meth.*, vi, 166 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 718 (1806); *Pers., Syn. Pl.*, ii, 606 (1807); *R. Br., Prodr. Fl. Nov. Holl.*, 245 (1810); *Aiton, Hort. Kew*, v, 368 (1813); *Thunb., Fl. Cap.*, ed. *Schultes*, 83 (1823); *Linn., Syst. Veg.*, ed. 16, i, p. 129 (1825); *Nees in Linnaea*, v, 634 (1830); *Endl., Gen. Pl.*, 122 (1836); *Harvey, Gen. S. Afr. Pl.*, 355 (1838); *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840); *Kunth, Enum.*, iii, 382 (1841); *Endl., Gen. Pl.*, Suppl. ii, p. 11 (1842); *Meisner, Gen. Pl.*, 408 (1842); *Steud., Synops. Pl.*, ii, 249 (1855); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 412 (1868); *Mast. in DC. Monog. Phan.*, i, 232, tab. i, figs. 12–19 (1878); *Benth. et Hook., Gen. Pl.*, iii, 1031 (1883); *Hieron. in Engl. et Prantl, Natur. Pflanzen*, ii, § 4, p. 8 (1888); *Mast. in Fl. Cap.*, vii, 61 (1897): **Rhodocoma,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 450 (1836); *Kunth, Enum.*, iii, 480; *Endl., Gen. Pl.*, Suppl. 2, p. 11; *Steud., Synops.*, ii, 248: **Ischyrolepis,** *Steud., op. cit.*, 249: **Craspedolepis,** *Steud., op. cit.*, 264; *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 416.

Flowers dioecious or rarely monoecious. Male spikelets usually many in panicled or spicate cymes, occasionally solitary and terminal, ovate, obovate, oblong, elliptic, rotundate, cylindric or subulate, terete or occasionally somewhat compressed, usually many-flowered, each with a spathe or spathella at its base; bracts usually many, imbricate or erect-spreading, mostly fertile. Perianth of 6 or rarely of 4 segments in 2 series, usually dorsally compressed, sometimes 3-sided, usually for the most part hidden by the bract; segments generally unequal, rigid, or membranous; the outer lateral generally conduplicate, navicular, mostly villous-carinate; the anterior segment almost flattened or rounded on the outer side; inner segments usually almost flattened, smaller, thinner. Anthers linear-oblong, apiculate or muticous. Rudimentary ovary with 2 or 3 minute styles or absent. Female spikelets many or few in panicled or spicate cymes, or solitary and terminal, like or unlike the male of the same species, many-, few-, or 1-flowered. Perianth generally as in the male, occasionally very unlike, usually larger; inner segments often thickening with the development of fruit. Staminodes generally 3, or absent. Ovary ovate, obovate, oblong, rotundate, or orbicular, compressed or 3-sided, 3- or, by abortion, 2- or 1-celled (when 2-celled the anterior cell is aborted, when 1-celled the anterior and one of the lateral cells are aborted); styles 3 or 2, adjacent at base or isolated (occasionally when 3 are present), free or variously connate

from the base to or shortly above the middle. Fruit capsular (the cells dehiscing at a vertical suture at the outer edge), compressed and 2- or 1-seeded, or 3-sided or 3-lobed and 3-seeded. Seeds smooth, tubercled, or with vertical ridges.

Flowering stems tufted or arising from a creeping rootstock, clothed at the base with clasping sheaths, erect or rarely reclining at base, terete, compressed or 4-sided, branched or simple; leaf-sheaths persistent, usually closely embracing the stem and more or less mucronate or aristate, rarely prolonged into a linear foliaceous mucro. Barren stems often present, weaker, shorter, and more branched than the fertile.

The genus is well represented also in Australia and Tasmania.

Key based on Characters in the Female Plants.

* Styles 3:

† Stems 4-angled:

Stems 6–10 dm. high, about 3 mm. in diam. at the middle (measured across the widest side); spikelets 6–8 mm. long, many-flowered; outer lateral perianth-segments villous on the carina . . . . . (6) *tetragonus.*

Stems 15–20 dm. high, about 5 mm. in diam. at the middle; spikelets 4–6 mm. long; outer lateral perianth-segments glabrous on the carina . (5) *quadratus.*

†† Stems more or less compressed, occasionally terete at base:

Stems slender in their upper parts, rigid in their lower; spikelets exceeding 1 cm. in length:

Spikelets about 2 cm. long; bracts acute, about 1 cm. long; perianth 3–3·5 mm. long; anterior segment elliptic . . . . . (42) *compressus.*

Spikelets 3–4 cm. long; bracts acuminate, about 2 cm. long; perianth 4–4·5 mm. long; anterior segment oblong-lanceolate . . . (43) *major.*

Stems filiform throughout; spikelets less than 1 cm. long:

Stems with many, often flexuose branches; ovary with 2 fertile cells, (23) *depauperatus.*

Stems simple or sparingly branched; ovary with 3 fertile cells:

Stems scarcely 0·5 mm. in diam.; spikelets 2·5–3 mm. long; perianth 1·5 mm. long . . . . . (22) *subtilis.*

Stems scarcely 1 mm. in diam.; spikelets 4–5 mm. long; perianth about 3 mm. long . . . . . (20) *stereocaulis.*

††† Stems terete (the upper branches may occasionally be somewhat angled or compressed):

Stems with very many, verticillately arranged, short, filiform branches, (4) *Rhodocoma.*

Stems without verticillately arranged branches:

‡ Ovary with 3 fertile cells:

§ Spikelets 1-flowered, occasionally or rarely 2-flowered:

Spikelets solitary or few in a spicate cyme:

Stems simple (perhaps occasionally branched); perianth sessile, (19) *miser.*

Stems moderately or much branched; perianth stipitate:

Spikelets oblong or cuneate, 4–5 mm. long; bracts acute or subacute, 3·3–5 mm. long; ovary oblong . . . . (21) *debilis.*

Spikelets elliptic or obovate, 6–7 mm. long; bracts obtuse, about 4 mm. long; ovary ovate . . . . (18) *similis.*

Spikelets many in a panicle:

Stems 0·3–1 m. high, 1–2 mm. in diam. at the middle, wiry or rather slender, very rarely with branches (which are sterile and solitary at almost every node); inflorescence 1–2 dm. long . (1) *fruticosus.*

Stems 1–2·5 m. high, 3–5 mm. in diam. at the middle, stout or if wiry then only so at the base of the inflorescence, mostly with a tuft of several, much divided, slender branches at each node on the middle portion; inflorescence 1·5–6 dm. long:

Perianth 4–4·5 mm. long; outer segments oblong-elliptic, obtuse or subacute; inner segments rotundate-ovate, obtuse . (2) *foliosus.*

Perianth 5·5–6 mm. long; outer segments oblong-lanceolate, acute; inner segments ovate, acute . . . . (3) *giganteus.*

§§ Spikelets many- or few-flowered:

Leaf-sheaths with a linear, foliaceous awn; spikelets 1·5–2 cm. long, (17) *quinquefarius.*

Leaf-sheaths with a subulate mucro; spikelets 0·8–1·2 cm. long, (50) *pedicellatus.*

‡‡ Ovary with 2 fertile cells (the aborted cell may contain a rudimentary ovule):

‖ Spikelets 1-flowered, occasionally or rarely 2-flowered:

Stems moderately or sparingly branched; perianth 7–8 mm. long, (27) *brachiatus.*

Stems much branched; perianth less than 6 mm. in length:

Stems rigid or wiry in their lower parts, with prominent tubercles; branches usually crowded on the upper parts of the stems; bracts lacerate-ciliate at the margins:

Leaf-sheaths on the branches with a slender awn equalling them or longer; perianth about 2 mm. long . . . (14) *scaberulus.*

Leaf-sheaths on the branches with a linear mucro about half their length; perianth 3–3·5 mm. long . . . (15) *Stokoei.*

Stems slender or filiform throughout, without prominent tubercles; branches usually rather evenly distributed from near the base of the stems upwards; bracts not lacerate-ciliate:

Stems filiform; branches usually capillary . . (24) *capillaris.*

Stems slender; branches usually filiform:

Perianth 5 mm. long; outer segments glabrous . (26) *patens.*

Perianth 4 mm. long; outer segments slightly villous on the carina . . . . . (25) *perplexus.*

|||| Spikelets 2-, several-, or many-flowered (in Fourcadei, cymosus, and leptostachyus the spikelets are often 1-flowered):

¶ Perianth much overtopping its bract:

Branches very many, short, filiform or capillary, crowded on the upper parts of the stems . . . . . (16) *Fourcadei.*

Branches many, few or absent, long and slender, not crowded:

Stems coarsely tubercled; leaf-sheaths tubercled . (51) *tuberculatus.*

Stems minutely tubercled; leaf-sheaths not tubercled:

Spikelets elliptic or rotundate; bracts ovate-rotundate, lacerate-ciliate at the margins; perianth elliptic, 3–3·5 mm. long; outer lateral segments villous on the carina . . (8) *sejunctus.*

Spikelets oblong or ovate-oblong; bracts ovate, pale-membranous at the margins; perianth oblong-lanceolate, 4·5–5 mm. long; outer-lateral segments glabrous on the carina . (28) *cymosus.*

¶¶ Perianth not or but very shortly overtopping its bract (the perianth is often more or less exposed at the sides of the bract):

Branches very much divided and crowded at the top of the stem, (46) *callistachyus.*

Branches moderately, not or much divided (in the only species, multiflorus, where the branches may be much divided the bracts are lacerate-ciliate):

Bracts lacerate-ciliate at the margins; perianth with its sides much exposed (branches moderately or much divided) . (7) *multiflorus.*

Bracts not lacerate-ciliate or if seeming to be so then the perianth is not much exposed at its sides; perianth with its sides not or but slightly exposed:

Outer lateral perianth-segments glabrous on the carina:

Bracts chartaceous, entirely pallid or pale brown, loosely imbricate or erect-spreading:

Spikelets many in a panicle, 5- or 6-flowered; perianth obliquely elliptic, 2·5–3 mm. long; ovary ovate . (37) *festucaeformis.*

Spikelets solitary (perhaps occasionally geminate), 1–3-flowered; perianth cuneate or oblong-cuneate, about 3·5 mm. long; ovary elliptic. . . . . (54) *leptostachyus.*

Bracts cartilaginous or coriaceous, purple-brown or at least so at the margins and apex, closely imbricate:

Stems stout in their lower parts, 6–9 dm. high; spikelets . solitary, about 3 cm. long; bracts subulate-mucronate; perianth about 10 mm. long . . . (41) *egregius.*

Stems slender throughout, 3–5 dm. high; spikelets several in spicate or panicled cymes; bracts mucronulate; perianth 4–5 mm. long . . . . . (49) *micans.*

Outer lateral perianth-segments more or less villous on the carina:

Stems with well-developed tubercles, on the upper and middle parts as well as on the lower, which show prominently on the outline:

Bracts ovate, coriaceous, with broad, pale-membranous upper margins; anterior perianth-segment glabrous on its median nerve . . . . . (52) *scaber.*

Bracts oblong-lanceolate, chartaceous; anterior perianth-segment occasionally villous on the upper portion of its median nerve . . . . . (53) *communis.*

Stems minutely, obsoletely or not tubercled (in purpurascens the tubercles on the basal parts of the stems are usually well developed):

Stems 1–1·5 dm. high; spikelets 2- or 3-flowered, 3–4 mm. long; perianth slightly compressed laterally, 1·5–1·75 mm. long; outer segments broadly obtuse at apex, (11) *Harveyi.*

Stems normally at least 2 dm. high; spikelets many-flowered, exceeding 5 mm. in length; perianth not compressed laterally, exceeding 2 mm. in length; outer segments acute at apex:

Spikelets broadly ovate, rotundate, or elliptic; bracts elliptic or rotundate, abruptly narrowed at the apex or narrowed upwards from above the middle:
Bracts with a rather long, stout, erect-spreading mucro:
Spikelets solitary or geminate, elliptic or ovate; bracts chestnut-brown on their upper parts and on the mucro, (35) *pachystachyus.*
Spikelets several in spicate or panicled cymes, broadly ovate or rotundate; bracts cinnamon-brown on their upper parts and on the mucro . (36) *brunneus.*
Bracts with a short, erect mucro or muticous:
Stems filiform, mostly 2–4 dm. high; leaf-sheaths rounded at apex; spikelets about 1 cm. long, (30) *filiformis.*
Stems slender, occasionally stout in their lower parts, mostly 4–8 dm. high; leaf-sheaths acute at apex; spikelets 1–2 cm. long:
Spikelets 1–1·5 cm. long, several or many in panicled or spicate cymes:
Stems usually furrowed by shrinkage in drying, grey-speckled; anterior perianth-segment with the upper half of its median nerve villous, (31) *bifurcus.*
Stems not furrowed, obsoletely tubercled; anterior perianth-segment with its median nerve glabrous, (32) *praeacutus.*
Spikelets 1·5–2 cm. long, 1–3 in a spicate cyme:
Bracts elliptic, obtuse, muticous; perianth 5 mm. long . . . . . (34) *strobilifer.*
Bracts rotundate, rounded at apex, shortly and stoutly mucronate; perianth 6–8 mm. long, (33) *Bolusii.*
Spikelets oblong, elliptic- or cuneate-oblong; bracts ovate or lanceolate, narrowed upwards from or below the middle:
Stems filiform; bracts with a distinct dark purple-brown band down the margins of the upper narrowed portion:
Perianth broadly elliptic, about 2·5 mm. long; outer lateral segments ovate-lanceolate; inner segments ovate acute . . . . (47) *bifidus.*
Perianth oblong-elliptic, 4 mm. long; outer lateral segments lanceolate; inner segments ovate-lanceolate, obtuse . . . (48) *exilis.*
Stems slender, occasionally stout in their lower parts; bracts without a dark purple-brown band on the upper margins:
Spikelets many in a panicle . . (29) *occultus.*
Spikelets few in spicate or subpanicled cymes:
Stems slender throughout, 3–4 dm. high; spikelets 1–1.8 cm. long; bracts brown, 7–8 mm. long, (10) *strictus.*

Stems rigid or wiry, usually stout in their lower parts, 5–12 dm. high; spikelets 2·5–3·5 cm. long; bracts, purple-brown, 1·5–2 cm. long:

Stems closely studded with obsolete, flat-topped, grey tubercles, except on the basal parts where the tubercles are usually well-developed and round-topped; bracts erect, chartaceous, purple-brown, membranous and pale at the margins, (44) *purpurascens.*

Stems almost smooth or rugulose, minutely grey-speckled; bracts erect-spreading at apex, cartilaginous, entirely dark purple-brown, somewhat undulate at the margins . . (45) *bifarius.*

‡‡‡ Ovary with 1 fertile cell (the aborted cell may contain a rudimentary ovule):

Spikelets 1- or 2-flowered:

Stems finely tubercled, 1–2 dm. high; perianth with its upper half exserted beyond the apex of the bract . . . . (12) *zwartbergense.*

Stems wrinkled, 2–7 dm. high; perianth not with any portion exserted beyond the apex of the bract:

Stems slender, with filiform branches and capillary branchlets; spikelets oblong or obovate, 4–5 mm. long; bracts ovate, rounded at apex; perianth 3 mm. long . . . . . (13) *arcuatus.*

Stems filiform, with capillary branches and branchlets; spikelets cuneate, 6–8 mm. long; bracts narrowly oblong-lanceolate, acuminate; perianth 2–2·75 mm. long . . . . . (55) *pusillus.*

Spikelets 2-, several-, or many-flowered:

Outer lateral perianth-segments distinctly winged on the upper half of the median nerve (flowers often monoecious) . . . (38) *Dodii.*

Outer lateral perianth-segments not winged:

Stems closely studded with flat-topped, whitish tubercles (on the basal parts of the stems the tubercles are usually more widely separated and better developed) . . . . . (9) *triticeus.*

Stems almost smooth, white-speckled, occasionally finely tubercled on the basal parts:

Spikelets several (occasionally geminate) or many in a spicate cyme; bracts lanceolate, 6–8 mm. long; perianth partly exposed, about 5 mm. long . . . . . (40) *dispar.*

Spikelets solitary or rarely geminate; bracts oblong-lanceolate, 1–1·3 cm. long; perianth hidden, 4 mm. long . . (39) *sarcocladus.*

** Styles 2:

† Spikelets 1- or 2-flowered:

Branches verticillate . . . . . (79) *leptocladus.*

Branches not verticillate:

Mucro of the leaf-sheaths twisted and flexuose . . (78) *Eleocharis.*

Mucro of the leaf-sheaths not twisted and flexuose:

Outer lateral perianth-segments villous on the carina:

Leaf-sheaths with the coriaceous portion truncate or rounded at apex, (70) *curviramis.*

Leaf-sheaths with the coriaceous portion acute or obtuse:

Stems obsoletely tubercled, sparingly branched; spikelets several or many in an inflorescence . . . . (71) *monanthus.*

Stems conspicuously tubercled, much branched; spikelets solitary or geminate . . . . . (77) *cincinnatus.*

Outer lateral perianth-segments glabrous on the carina:

Stems slender:

Stems almost smooth, with slightly raised, whitish speckles; spikelets about 3; perianth about 4 mm. long; segments 6, (73) *rottboellioides.*

Stems tubercled; spikelets several or many; perianth 3 mm. long; segments 4 . . . . . (76) *Duthieae.*

Stems filiform:

Spikelets solitary or rarely 2 or 3 . . . (75) *tenuissimus.*

Spikelets several or many:

Stems tubercled . . . . . (76) *Duthieae.*

Stems almost smooth . . . . . (83) *paludosus.*

†† Spikelets several- or many-flowered (in coactilis and sabulosus there occasionally occur 2-flowered spikelets):

Branches verticillate . . . . . (69) *subverticillatus.*

Branches not verticillate:

‡ Leaf-sheaths loosely stem-clasping, with the upper half erect-spreading:

Spikelets 0·6–1 cm. long; bracts mucronate; perianth 2·5–4 mm. long, (68) *Gaudichaudianus.*

Spikelets 1 cm. long or longer; bracts aristate; perianth 4 mm. long or longer:

Stems more or less tubercled or rugose . . . (56) *cuspidatus.*

Stems more or less rugulose or smooth:

Leaf-sheaths red-brown, dull, acute or acuminate at apex; perianth 6–7 mm. long . . . . . (57) *ocreatus.*

Leaf-sheaths chestnut-brown, shiny, rounded or obtuse at apex; perianth 5–6 mm. long . . . . . (58) *fraternus.*

‡‡ Leaf-sheaths closely stem-clasping or if loose then not with the upper half erect-spreading:

§ Leaf-sheaths in some or most cases with a partly exserted woolly scale arising in the axil:

Styles conspicuously villous on the outer surface. . (66) *gossypinus.*

Styles not villous on the outer surface:

Stems obsoletely tubercled . . . (63) *laniger*, var. *distractus.*

Stems smooth or obscurely wrinkled:

Leaf-sheaths, when untarnished, nervose-striate, distinctly grey- or yellow-speckled over the entire outer surface . (67) *Sieberi*, var. *venustulus.*

Leaf-sheaths, when untarnished, smooth and glossy, without speckles or indistinctly speckled on their lower parts:

Stems smooth, minutely white-speckled; perianth . mm. long, (64) *coactilis.*

Stems obscurely rugulose, with faint transverse, wavy, brown lines; perianth 6–7 mm. long . . . . . (63) *laniger.*

§§ Leaf-sheaths without a partly exserted woolly scale:

Outer lateral perianth-segments glabrous on the carina, (85) *obtusissimus.*

Outer lateral perianth-segments villous on the carina:

Leaf-sheaths loosely stem-clasping:

Bracts with an erect-spreading or recurved awn . (56) *cuspidatus.*

Bracts with an erect mucro . . . . (68) *Gaudichaudianus.*
Leaf-sheaths closely stem-clasping :
Bracts with an awn more than half their length :
Stems simple or sparingly branched ; spikelets solitary or geminate ; perianth 5–6 mm. long . . . . . (59) *setiger.*
Stems moderately or much branched ; spikelets many in spicate or panicled cymes ; perianth 7–9 mm. long . . (60) *hystrix.*
Bracts mucronate or shortly aristate :
Spikelets subulate or cylindric, very acute at apex :
Stems filiform, rugose or finely tubercled ; leaf-sheaths with the apex of the coriaceous portion acute . . (80) *triflorus.*
Stems slender, rugulose or smooth ; leaf-sheaths with the apex of the coriaceous portion obtuse or rounded :
Spikelets solitary or geminate, 1–2 cm. long ; perianth 3·5–4 mm. long . . . . . (84) *Helenae.*
Spikelets several or many, 0·6–1 cm. long ; perianth 2·5–3 mm. long . . . . . (82) *Wallichii.*
Spikelets oblong- or ovate-lanceolate, oblong, elliptic or ovate :
|| Stems obsoletely or finely tubercled :
Leaf-sheaths with the apex of the coriaceous portion rounded or truncate . . . . . (81) *macer.*
Leaf-sheaths with the apex of the coriaceous portion acute :
Spikelets solitary ; bracts with rather prominent shoulders ; perianth-segments 4. . . . (62) *Marlothii.*
Spikelets 1–3 or many ; bracts without definite shoulders ; perianth-segments 6 :
Spikelets 1–1·5 cm. long ; bracts acute, 4·5–6 mm. long; perianth 4–5 mm. long ; outer lateral segments, lanceolate, apiculate ; styles connate up to about the middle, (65) *vilis.*
Spikelets 0·6–0·8 cm. long ; bracts obtuse, 4–5 mm. long ; perianth 2–2·5 mm. long ; outer lateral segments ovate-lanceolate, acute ; styles connate at base only, (72) *aridus.*
|||| Stems obscurely wrinkled, smooth or almost so :
Leaf-sheaths distinctly grey- or yellow-speckled over their entire outer surface :
Stems slender, sparingly branched or simple, mostly 4–6 dm. high ; spikelets 1–3 (rarely 4), 8–15 mm. long, in a spicate cyme. . . . . (67) *Sieberi.*
Stems rigid or wiry, usually rather stout in their lower parts, much branched or simple, mostly 6–10 dm. high ; spikelets several (occasionally fewer when accompanying retarded growth of stems) or many, 7–9 mm. long, in spicate or panicled cymes . (68) *Gaudichaudianus*, var. *luxurians.*
Leaf-sheaths not or but indistinctly speckled :
Spikelets 5–6 mm. long ; perianth 2·5–3 mm. long, (74) *sabulosus.*
Spikelets 8–15 mm. long ; perianth exceeding 3 mm. in length :

Stems obscurely wrinkled; leaf-sheaths indistinctly grey- or yellow-speckled . (67) *Sieberi*, var. *schoenoides*.
Stems smooth or nearly so, minutely white- or yellow-speckled; leaf-sheaths not or faintly speckled, (61) *virgeus*.

Key to the imperfectly known Species based on Characters in the Male Plants.

Bracts curved outwards in their upper parts . . . . . (86) *echinatus*.
Bracts straight:
Outer lateral perianth-segments hispid on the carina . . (87) *Sonderianus*.
Outer lateral perianth-segments glabrous and smooth on the carina:
Stems finely tubercled . . . . . (88) *crinalis*.
Stems wrinkled and white-speckled . . . . . (89) *oblongus*.

1. R. fruticosus, *Thunb., Diss. Rest.*, 16 (1788)!; *in Usteri, Delect.*, i, 50 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 172 (1806); *Willd., Sp. Pl.*, iv, pars 2, p. 724 (1806); *Thunb., Fl. Cap.*, ed. 1, p. 329 (1811); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. *Schultes*, 86 (1823); *Spreng., Syst. Veg.*, i, 185 (1825); *Kunth, Enum.*, iii, 413 (1841); *Steud., Synops. Pl.*, ii, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 254 (1865); *Thunb. Herb. ex. Mast. in Journ. Linn. Soc.*, xiv, 417 (1875): **Thamnochortus modestus,** *Kunth, Enum.*, iii, 434!; *Steud., op. cit.*, 259: **Leptocarpus modestus,** *Mast. in Journ. Linn. Soc.*, x, 225 (1868)!; *in DC. Monog. Phan.*, i, 337 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 517 (1895), excl. syn. *R. paleaceus, Nees*; *Mast. in Fl. Cap.*, vii, 119 (1897): **Restio MacOwani,** *Pillans in Ann. Bolus Herb.*, iii, 80, tab. v, fig. A (1921).

Stems caespitose or arising from creeping rhizomes, erect, terete, wiry or rather slender, sometimes rather stout in the lower parts, smooth or almost so, and white-speckled, occasionally obsoletely tubercled, 3–10 dm. high, 1–2 mm. in diameter at the middle, rarely with a barren branch at some or each of the nodes; sheaths closely convolute, lanceolate or oblong-lanceolate, acute or acuminate, mucronate or aristate, coriaceous, cartilaginous or membranous and soon lacerate at the upper margins, prominently nerved, ferruginous, mostly 3–4 cm. long with the mucro or awn; male spikelets very many, in diffuse paniculate cymes, elliptic or obovate, obtuse, 5–8-flowered, 4–6 mm. long; spathe at the base of each spikelet vate-lanceolate, acute, aristate, membranous, and lacerate in its upper parts, half as long as or equalling the spikelet; bracts loosely imbricate, ovate, acute or obtuse, mucronulate, cartilaginous, dark brown, narrowly pale-membranous at the margins, 3–5 mm. long; perianth hidden, shortly stipitate, ovate-elliptic, 2–2·5 mm. long; outer segments oblong, subacute or obtuse, cartilaginous, glabrous; the lateral obtusely carinate; inner segments lanceolate, subacute or obtuse, submembranous, slightly shorter than the

outer; female spikelets many in a narrow, usually dense, occasionally interrupted panicle, lanceolate, acute, 1-flowered, 5–8 mm. long; spathe lanceolate, acuminate, for the most part pale-membranous, soon becoming lacerate, about as long as the spikelet; bracts 3–5, closely imbricate, ovate, acute, mucronulate, cartilaginous, purple-brown, rather widely pale-membranous at the margins, 2·5–4 mm. long; perianth with $\frac{1}{3}$–$\frac{1}{2}$ of its upper portion exserted beyond the bracts, shortly stipitate, lanceolate or oblong-lanceolate, rounded at base, trigonous, 4–6 mm. long; outer segments all alike, oblong, acute, dorsally rounded, coriaceous, glabrous, purple-brown; inner segments lanceolate, acute, cartilaginous, membranous at the margins, slightly shorter; ovary trigonous, rotundate, 3-celled; styles 3, adjacent, free, densely villous from the base to the apex; capsule 3-seeded; seeds smooth.

South Africa : without precise locality, *Thunberg*, ♀, *Drège*, 7, ♀.

Cape Province—Cape Div.: Cape Flats, *Buchanan*, 158, ♂, 160, ♀; flats at Wynberg, *Ecklon*, 568, ♂, *Page in Bolus Herb.*, 16624, ♀.—Caledon Div.: Houwhoek, *Schlechter*, 7764, ♀; Koude River, *Schlechter*, 10461, ♂, 10462, ♀.—Worcester Div.: Touws River, *Marloth*, 3159, ♂ and ♀.—Montagu Div.: hills near the Baths, *Mitchell in Bolus Herb.*, 15601, ♀.—Laingsburg Div.: Witte Bergen, near Matjesfontein, *Marloth*, 3151, ♂.—Ladismith Div.: Zwarte Bergen, near Ladismith, *Marloth*, 3166, ♀; Klein Zwart, Berg Pass, *Marloth*, 3655, ♀, 3657, ♀, 3658, ♂; Swannepoel's Poort Berg, *Marloth*, 3660, ♂.—Prince Albert Div.: Zwarte Bergen, near Klaarstroom, *Drège*, 138*b*, ♂.—Riversdale Div.: Phisantefontein, north slopes of Lange Bergen, *Muir*, 3190, ♀.—George Div.: near George, *Rogers*, 4319, ♂.—Uniondale Div.: Uniondale, *Paterson*, 3009, ♂; Uniondale Road, *Paterson*, 3013, ♀, *Tugwell in Bolus Herb.*, 14288, ♂; Steytlerville, *Paterson*, 19, ♂; hills near Avontuur, *Fourcade*, 2082, ♂; headwaters of Wagenbooms River, *Fourcade*, 2341, ♂.—Willowmore Div.: Aasvogelberg, *Andreae*, 954, ♂, 958*a*, ♂, 958*b*, ♀, 983, ♀.—Uitenhage Div.: near Uitenhage, *unknown collector in Harvey's herbarium*, 130, ♂.—Albany Div.: hills near Grahamstown, *MacOwan*, 1361, ♂, *Daly and Sole*, 36, ♂, *White*, 34, ♂; Riebeek, *Burchell*, 3470, ♂.

The male and female inflorescences show considerable variation in size, varying from 1–2 dm. in length, and often have an interruption in their lower parts. There is much similarity between the male inflorescence and that of some species of Thamnochortus, but the male flower lacks the acutely keeled outer segments of the perianth which occur in that genus. Masters quoted Schlechter's plants, 10461, ♂, and 10462, ♀, which are included here, with the types of his *Thamnochortus pluristachyus* in *Engler's Bot. Jahrb.*, xxix, Beibl. 66, p. 12, but he does not appear to have used them in drawing up his description. The stems of Thunberg's plant are almost

slender, but this may be due to the presence of several barren stems which would reduce the vigour of the flowering ones.

2. R. foliosus, *N. E. Br. in Fl. Cap.*, vii, 753 (1900) !.

Stems erect, stout, often wiry below the inflorescence, terete, smooth or nearly so, more or less puncticulate, 1–1·5 m. high, 3–4 mm. in diameter at the middle, mostly with a tuft of several much divided, slender, barren branches at each node on the middle portion; sheaths closely convolute, ovate to ovate-lanceolate, acute or acuminate, mucronate or with a slender awn, coriaceous, nervose, red-brown, broadly pale-membranous at the upper margins, mostly 3–4 cm. long; male spikelets very many, in diffuse paniculate cymes which compose a rather lax inflorescence 1·5–3 dm. long; spikelets 5–10 mm. long, elliptic or obovate, acute at base, subacute at apex, several- or many-flowered; spathe broadly ovate, acute or acuminate, mucronate or aristate, cartilaginous, deeply pale-membranous at the upper margins, reaching to about the middle of the spikelet; bracts loosely imbricate, elliptic, obtuse, mucronate, cartilaginous, narrowly pale-membranous at the upper margins, 3·5–4 mm. long; perianth exposed at its apex, shortly stipitate, elliptic or oblong-elliptic, about 3 mm. long; outer segments linear-oblong, acute, cartilaginous, glabrous; the lateral navicular, slightly carinate; inner segments elliptic-oblong, subacute, membranous; female spikelets many, in erect, paniculate cymes which compose an oblong or linear, more or less interrupted inflorescence 1–3 dm. long; spikelets 5–7 mm. long, lanceolate or ovate-lanceolate, 1- or, very rarely, 2-flowered, occasionally including an aborted flower; spathe as in the male; bracts 2 or several, closely imbricate, orbicular, rounded at the apex, mucronate or muticous, membranous, red-brown, narrowly pale-margined, 2–3 mm. long; perianth with its upper half exserted, on a short swollen stipe, lanceolate-ovate, trigonous, rounded at base, 4–4·5 mm. long; outer segments oblong-elliptic, obtuse or subacute, dorsally rounded, coriaceous, chestnut-brown; inner segments rotundate-ovate, obtuse, cartilaginous, membranous at the margins, slightly shorter; ovary rotundate, trigonous, 3-celled; styles 3, separated at base, densely villous from the base to the apex; capsule 3-seeded; seeds rotundate, smooth.

South Africa: Cape Province—Riversdale Div.: Garcia's Pass, *Burchell*, 6994, ♂, *Galpin*, 4783, ♂ and ♀, *Bolus*, 11392, ♂, 11397, ♀, *Marloth*, 3633, ♀; Glen Leith, south slopes of the Lange Bergen, near Riversdale, *Muir*, 3302, ♂ and ♀.

3. R. giganteus, *N. E. Br. in Fl. Cap.*, vii, 755 (1900) !: **Thamnochortus giganteus,** *Kunth, Enum.*, iii, 435 (1841) !; *Steud., Synops. Pl.*, ii, 259 (1855); *Mast. in Journ. Linn. Soc.*, x, 231 (1868); *in DC. Monog. Phan.*, i, 315 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 519 (1895); *Mast. in Fl. Cap.*, vii, 121 (1897): **R. comosus,** *N. E. Br., op. cit.* 753 !.

Stems erect, stout, often wiry at the base of the inflorescence, terete, smooth or nearly so, more or less puncticulate, 1–2·5 m. high, 3–4 mm. in diameter at the middle, mostly with a tuft of several much divided, slender, barren branches at each node of the middle portion; sheaths closely convolute, ovate to ovate-lanceolate, acute or acuminate, mucronate or aristate, coriaceous, nervose, red-brown, broadly pale-membranous and soon becoming lacerate at the upper margins, mostly 4–5 cm. long; male spikelets very many, in diffuse paniculate cymes which form a lax plume-like inflorescence 3–5 dm. long; spikelets 7–12 mm. long, elliptic, oblong-elliptic or obovate, obtuse or subacute at the apex, many-flowered; spathe ovate, acute, mucronate or aristate, cartilaginous, broadly membranous at the upper margin, not reaching to the middle of the spikelet; bracts loosely imbricate, elliptic or ovate-elliptic, acute, mucronulate, cartilaginous, dark brown, narrowly pale-membranous at the margins, about 4 mm. long; perianth hidden by its bract, shortly stipitate, elliptic or oblong-elliptic, 3–3·5 mm. long; outer segments linear-oblong, cartilaginous, glabrous; the lateral navicular, acute; the anterior obtuse; inner segments oblong-lanceolate, submembranous; the lateral acute; the posterior obtuse; female spikelets many, in erect paniculate cymes which form a narrow inflorescence about 2 dm. long; spikelets 6–8 mm. long, lanceolate or ovate-lanceolate, with 1 flower which occupies the apex; spathe broadly ovate, acute or acuminate, mucronate or aristate, coriaceous, deeply membranous at the upper margin, reaching to about the middle of the spikelet; bracts several, closely imbricate, rotundate or ovate, rounded, obtuse or subacute at the apex, mucronulate or obsoletely so, deeply concave on the inner side, coriaceous, chestnut-brown, very narrowly pale-membranous at the margins, 3–4 mm. long; perianth with its upper half exserted, shortly stipitate, lanceolate or oblong-lanceolate, trigonous, 5·5–6 mm. long; outer segments all alike, oblong-lanceolate, acute, dorsally rounded, coriaceous, chestnut-brown on the exposed parts; inner segments ovate, acute, cartilaginous, membranous at the margins, distinctly shorter; ovary rotundate, trigonous, 3-celled; styles 3, separated at base, densely villous from the base to the apex; capsule 3-seeded; seeds rotundate, smooth.

South Africa: Cape Province—George Div.: between Long Vley and Touw River, *Burchell*, 5711/2, ♂; Montagu Pass, *Schlechter*, 5808, ♂; near George, *Rogers*, 4317, ♂ and ♀.—Knysna Div.: the Glebe, *Galpin*, 4781, ♂ and ♀, 4784, ♂.—Humansdorp Div.: Kromme River, *Drège*, 2, ♂; Witte Els Bosch, *Galpin*, 4782, ♂ and ♀; flats at Witte Els Bosch, *Fourcade*, 814, ♂, 1416, ♀; between Hofmann's Bosch and Kareedouw, *Britten*, 1093, ♀, 1307, ♀.—Uitenhage Div.: Elands River, *Schönland*, 3669, ♀.

4. R. Rhodocoma, *Mast. in Journ. Linn. Soc.*, x, 275 (1868)!; *in DC. Monog. Phan.*, i. 294 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510

(1895); *Mast. in Fl. Cap.*, vii, 93 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 10 (1900): **Rhodocoma,** *Nees in Lindl. Nat. Syst.*, ed. 2, p. 450 (1836)!; *Kunth, Enum.*, iii, 480 (1841): **R. capense,** *Nees ex Steud., Synops. Pl.*, ii, 249 (1855)!: **R. Equisetum,** *Nees ex Mast. in Journ. Linn. Soc.*, x, 275!.

Stems erect, stout and rigid, terete, smooth or faintly wrinkled, 1–1·5 m. high, about 3 mm. in diameter at middle, with very many verticillately arranged branchlets at the upper nodes; branchlets erect, filiform, much divided, angular in their lower parts and somewhat compressed in their upper, mostly 1–2 dm. long, occasionally less than 5 cm. long, the lower often barren, the upper usually all flowering; sheaths on the main stems closely convolute except in their upper parts, oblong, acuminate, with a deciduous awn, coriaceous, deeply membranous and soon becoming lacerate in the upper half, nervose, mostly 2·5–4 cm. long with the awn; sheaths on the branchlets oblong, acuminate, slender-aristate, deeply hyaline at the upper margins, mostly 1–2 cm. long with the awn; male spikelets very many, in panicled cymes, oblong or oblanceolate, tapered downwards in the lower half, many-flowered, 5–8 mm. long; lower spathes sheath-like, the upper bract-like and inconspicuous; bracts loosely imbricate, ovate, acute, mucronulate, cartilaginous, with narrow, pale-membranous margins, red-brown, about 3 mm. long; perianth usually partly exposed at the side of the bract, shortly stipitate, oblong, about 2 mm. long; segments oblong-lanceolate, obtuse, cartilaginous, glabrous; the outer lateral navicular; the anterior dorsally rounded; inner segments subacute, submembranous; female spikelets 1–4 in a spicate cyme, ovate and 1-flowered or rotundate and 2-flowered, 4–5 mm. long; spathe sheath-like; bracts few, closely imbricate, broadly ovate or elliptic, obtuse, mucronulate, cartilaginous, narrowly membranous at the margins, red-brown on the exposed parts, about 2 mm. long; perianth with about half its length protruding beyond the bract, stipitate, broadly oblong or elliptic, obtusely 3-angled, about 3 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, sub-navicular, glabrous; inner segments oblong-ovate, obtuse, cartilaginous, membranous at the margins; ovary rotundate, trigonous, 3-celled; styles 3, separated at base, densely villous along the entire length of the inner surface; capsule 3-seeded.

South Africa: Cape Province—Ceres Div.: Koude Bokkeveld, *Schlechter*, 8868, ♂, 8869, ♂; Driefontein, *Marloth*, 6181, ♂.—Prince Albert Div.: Zwartberg Pass, *Tugwell in Bolus Herb.*, 14285, ♂.—Willowmore Div.: Aasvogelberg, *Andreae*, 995, ♂.—Humansdorp Div.: Humansdorp, *Schlechter*, 6021, ♂ and ♀.—Somerset East Div.: Commadagga, *Burchell*, 3322, ♂ and ♀.—Port Elizabeth Div.: Zwartkops River, *Zeyher*, ♀; Van Staadens, *Paterson*, 2419, ♂.—Alexandria Div.: on the rocks

in Zwartwater Poort, *Burchell*, 3373, sterile; Zuurberg, *Drège*, 2016, ♂ and ♀, *Paterson*, 68, ♂.—ALBANY DIV.: near Riebeek, *Burchell*, 3509, ♂.

5. R. quadratus, *Mast. in Journ. Linn. Soc.*, x, 277 (1868)!; *in DC. Monog. Phan.*, i, 293 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895), excl. syn.; *Mast. in Fl. Cap.*, vii, 95 (1897).

Stems arising sporadically from a creeping rootstock, erect, stout, 4-sided and sharply 4-angled, smooth or faintly striate, 1·5–2 m. high, about 5 mm. in diameter at middle, much divided in their upper parts into slender branches and filiform branchlets; sheaths on the main stems closely convolute, oblong or ovate, acute, mucronate, coriaceous, thinner at the upper margins, coarsely striate, red-brown, the lower about 5 cm. long, those at the middle 3–4 cm. long; branchlets sterile, angular, with foliaceous sheaths; male spikelets many, in lax panicles, ovate-oblong or obovate, 3–6-flowered, 4–5 mm. long; spathe at the base of each spikelet bract-like but smaller; bracts oblong-ovate, acute, mucronulate, cartilaginous, narrowly membranous at the margins, 2 mm. long; perianth oblong, equalling or slightly exceeding its bract; outer segments lanceolate-oblong, acute, cartilaginous, glabrous; the lateral carinate; inner segments, linear-oblong, obtuse, membranous; female spikelets many, in panicled cymes, obovate or rotundate, 2–4-flowered, 4–6 mm. long; spathe bract-like; bracts oblong-ovate, acute, mucronate, subcoriaceous, membranous at the margins, 2–2·5 mm. long; perianth partly exposed, shortly stipitate, 3-sided, oblong-ovate, 3 mm. long; segments oblong, acute, cartilaginous, subequal; the outer lateral carinate, glabrous; the anterior with a prominent midrib; inner segments flattened; ovary rotundate, 3-celled, trigonous; styles 3, adjacent at base, free; capsule 3- or, by abortion, 1- or 2-seeded.

South Africa: without precise locality, *Dr. Hermann in Sloane's Herb., British Museum*, sterile, *Niven*, ♀, *Drège*, 364*c*, ♀, *Pappe*, 96, ♀.

Cape Province—CAPE DIV.: vicinity of Cape Town, *Burchell*, 408 partly, ♂; Table Mt., *MacGillivray*, 435, sterile; slopes of Devil's Peak, above Newlands, *Wilms*, 3796, sterile; Second Waterfall Ravine, Devil's Peak, *Pillans*, 4375, ♂ and ♀; eastern slopes of Table Mt., *Bolus*, 7220, ♀, *Pillans*, 3889, ♂ and ♀; south slopes of Noord Hoek Mt., *Pillans*, 4379, ♀.—PAARL DIV.: French Hoek, *Schlechter*, 9287, ♀.—CALEDON DIV.: Baviaans Kloof, Genadendal, *Burchell*, 7778 partly, immature ♀.

6. R. tetragonus, *Thunb., Diss. Rest.*, 17 (1788)!; *in Usteri, Delect.*, 51 (1790); *ej. Prodr. Cap.* 15 (1794); *Poir. in Lam., Encycl. Meth.*, 171 (1804); *Willd., Sp. Pl.*, iv, 725 (1806); *Thunb., Fl. Cap.*, ed. 1, p. 332 (1811); ed. *Schultes*, 87 (1823); *Spreng., Syst. Veg.*, i, 185 (1825); *Nees in Linnaea*, v, 642 (1830); vii, 616 (1832); *Kunth, Enum.*, iii, 401 (1841); *Drège, Zwei Pfl.*

Documente, 106 (1844); *Steud., Synops.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 245 (1865); *Thunb. Herb. ex Mast., op. cit.*, xiv, 418 (1875); *Mast. in DC. Monog. Phan.*, i, 273 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 512 (1895); *Mast. in Fl. Cap.*, vii, 81 (1897).

Stems arising sporadically from creeping rhizomes, erect, simple or producing fertile or sterile, divided branches at the upper nodes, rigid and rather stout in their lower parts, slender in their upper, 4-sided, about oblong in transverse section, with acute angles, smooth or finely wrinkled, 6–10 dm. high, about 3 mm. in diameter at the middle as measured across the broadest side; sheaths closely convolute, oblong-lanceolate, acute, with an adpressed mucro, striate, averaging 2·5 cm. in length; barren stems often many, much branched; branchlets with foliaceous sheaths; male spikelets many, in elongated, panicled cymes, broadly oblong, obtuse at apex, many-flowered, 8–10 mm. long; spathes and spathellae like the upper sheaths but smaller, soon becoming lacerated; bracts erect-spreading, ovate-lanceolate, acute, mucronate, cartilaginous, membranous at the margins, 4 mm. long; perianth shortly stipitate, elliptic or obovate, 3 mm. long; segments oblong-lanceolate, acute; the inner slightly shorter and narrower than the outer; outer segments rigid, submembranous; the lateral villous-carinate; the anterior dorsally rounded, glabrous; inner segments hyaline-membranous; female inflorescence like that of the male plant; spikelets many, ovate or oblong-ovate, many-flowered, 6–8 mm. long; spathes, spathellae, and bracts as in the male; perianth shortly pedicellate, elliptic or obovate, obtuse at apex, 3 mm. long; segments as in the male except that the inner are broader and thicker; ovary obovate, 3-sided, 3-celled; styles 3, free, densely villous at base; capsule 2- or, by abortion, 1-seeded.

South Africa: without precise locality; *Oldenburg, Thunberg*, ♂ and ♀, *Masson, Drège*, 364, ♂, *Sieber*, 118, ♀.

Cape Province.—Cape Div.: vicinity of Cape Town, *Burchell*, 408 partly, sterile, 461, ♂, 499, ♀; flats near Rondebosch, *Burchell*, 186; Rondebosch, *Alexander*, ♀; east side of Table Mt., *Drège*, 364*b*, ♂; near the Waterfall, Devil's Peak, *Ecklon*, 34 partly, ♀, *Wilms*, 3793, ♂; east slopes of Devil's Peak, *Bolus*, 4460, ♂, 4461, ♀, 4462, ♀; Table Mt., *Moss*, 7856, ♂; Camp's Bay, *Alexander*, ♀; between Rondebosch and Hout Bay, *Drège*, 364*a*, ♂; Constantia, *Ecklon and Geyher*, ♂ and ♀; False Bay, *Robertson*; near Hout Bay, *Wolley-Dod*, 2646, ♀; north slopes of the Steenberg, *Pillans*, 3570, ♂ and ♀; plateau south of Simon's Town, *Pillans*, 3607, ♂ and ♀; Cape Point, *Marloth*, 3187, ♂.—Caledon Div.: Steenbraas, *Rogers*, 11137, ♂; Vogel Vley, *Schlechter*, 10289 or 10489.—Tulbagh Div.: Tulbagh Kloof, *L. Diels*, 1086, ♀.—Swellendam Div.: hills at Swellendam, *Pappe*, ♂ and ♀.—George Div.: George, *Rogers*, 4115, ♀, 4116, ♀.—Knysna Div.: hills near Melville, *Burchell*, 5463, ♂ and ♀.—Humansdorp Div.: Humansdorp, *Rogers*,

4111, ♂ and ♀; Assegai Bush, *Rogers*, 2813, ♀, 4676, ♀.—Port Elizabeth Div.: Walmer, *Paterson*, 2365, ♀.—Albany Div.: Fish River Rand, *Hutton in Albany Mus. Herb.*, ♂ and ♀.

7. R. multiflorus, *Spreng., Syst. Veg.*, i, 187 (1825)!; *Nees in Linnaea*, v, 646 (1830); *Kunth, Enum.*, iii, 412 (1841); *Steud., Synops. Pl.*, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 244 (1865); *ibid.*, xxi, 575 (1885); *in DC. Monog. Phan.*, i, 279 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895), excl. syn. omn.; *Mast. in Fl. Cap.*, vii, 85 (1897): **Calopsis neglecta,** *Hochst. in Flora*, 1845, p. 338!; *Steud., op. cit.*, 258: **R. triticeus,** var. **gracilis,** *Nees ex Drège in Linnaea*, xx, 241 (1847)!, nomen: **Leptocarpus neglectus,** *Mast. in Journ. Linn. Soc.*, x, 225 (1868)!; *in DC. Monog. Phan.*, i, 334; *Durand et Schinz, op. cit.*, 517; *Mast. in Fl. Cap.*, vii, 117: **Restio protractus,** *Mast. in Fl. Cap.*, vii, 97!.

Stems arising sporadically from creeping rhizomes, erect, terete or somewhat compressed in the upper parts, tubercled at base, elsewhere rugulose or nearly smooth, white-speckled, usually 1–1·5 m. high, stout in the lower parts, becoming slender from about the middle upwards, with many slender, somewhat compressed branches arising from the upper nodes; sheaths closely convolute, ovate or elliptic, acute or acuminate, aristate, coriaceous, nervose, purple-brown, grey-speckled, mostly 2·5–3 cm. long on the main stem, with the upper margins pale-membranous and deciduous; male spikelets many in panicled or spicate cymes, broadly oblong or elliptic, many-flowered, usually 1–1·5 cm. long; spathe sheath-like, ovate, aristate, scarcely reaching to the middle of the spikelet; bracts erect-spreading, ovate, acute, mucronate, cartilaginous, finely lacerate-ciliate at the margins, about 5 mm. long; perianth partly exposed, shortly stipitate, elliptic-oblong, 3–4 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, villous-carinate; inner segments lanceolate, acute, hyaline; female spikelets many, in panicled or spicate cymes, broadly oblong, becoming rotundate with fruiting, mostly 6–9-flowered, 1–2 cm. long; spathes as in the male; bracts erect-spreading, as in the male, 4–6 mm. long; perianth partly exposed, shortly stipitate, elliptic, 3–4 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral villous-carinate; inner segments lanceolate, acute, hyaline; ovary rotundate, compressed, 2-celled; styles 3, subadjacent at base, free; capsule 2-seeded; seeds trigonous, smooth.

South Africa: without precise locality, *Verreaux*, ♀.

Cape Province—Cape Div.: by the waterfall on Table Mt., *Ecklon*, 36 partly, ♀; Table Mt., *Bolus*, 4438, ♀, 4442, ♂, 4443, ♀, *Pillans*, 3608, ♂ and ♀, *A. Engler*, 142, ♀; Devil's Peak, *Drège*, 90, ♀, *Bolus*, 4469, ♀, *Wolley-Dod*, 2677, ♂; Lion's Head, *Alexander*, ♀; dell on south side of Kirstenbosch Ridge, *Page in Bolus Herb.*, 16029, ♂.—Paarl Div.: Paarl Mt., *Drège*, 68, ♀.

—Caledon Div.—between Root Wood Station and Houwhoek, *Burchell*, 8016 partly, ♂.

Var. β, tuberculatus (*Pillans*); stems closely studded from near the base upwards with depressed whitish tubercles, studded on the basal parts with rounded tubercles as in the typical form.

Cape Div.: on upper east slopes of Lion's Rump, *Pillans*, 4395, ♂ and ♀.

8. R. sejunctus, *Mast. in Fl. Cap.*, vii, 97 (1897)!: **R. multiflorus,** *Mast. in Journ. Linn. Soc.*, xxi, 575 (1885)!, non *Spreng.*

Stems arising sporadically from a creeping rootstock, erect, terete, rigid, and minutely whitish-tubercled in the lower half, slender and whitish-speckled in the upper, sparingly branched above the middle, 5–9 dm. high; sheaths closely convolute, ovate or elliptic-ovate, acute, mucronate, coriaceous, almost smooth, purplish, grey-speckled, about 1·5 cm. long on the main stem, with deciduous, broadly membranous upper margins; male spikelets many, in spicate or subpanicled cymes, elliptic or obovate, many-flowered, 5–8 mm. long; spathe sheath-like, about half as long as the spikelet; bracts loosely imbricate, ovate-rotundate, obtuse or subacute, muticous or minutely mucronulate, cartilaginous, finely lacerate at the margins, 3–4 mm. long; perianth stipitate, elliptic, about 2·5 mm. long; outer segments oblong-lanceolate, cartilaginous; the lateral acute, villous-carinate; the anterior obtuse, glabrous; inner segments lanceolate, obtuse, membranous; female spikelets many, in spicate or subpanicled cymes, elliptic or rotundate, 2- or 3-flowered, 5–8 mm. long; spathe as in the male; bracts forced outwards by the flowers, ovate-rotundate, acute, soon becoming obtuse or rounded by the disintegration of the upper margin, mucronulate, cartilaginous, finely lacerate-ciliate at the margins, pitted on the dorsal surface, 3–4 mm. long; perianth partly exposed beyond the sides and apex of its bract, stipitate, elliptic, 3–3·5 mm. long; outer segments oblong-lanceolate, obtuse; the lateral navicular, villous-carinate; the anterior glabrous; inner segments lanceolate, obtuse submembranous; ovary elliptic, 2-celled; styles 3, free.

South Africa: Cape Province—Somerset East Div.: Boschberg, *MacOwan*, 1783, ♀, *Bennie*, 446, ♀.—Albany Div.: without precise locality, *Colonel Bolton*, ♂, *T. W. in Herbarium of Trinity College, Dublin*, ♀; near Grahamstown, *Schönland in Albany Museum*, ♂, *Rogers*, 3198, ♂.

9. R. triticeus, *Rottb., Programm.*, 11 (1772); *ejusd. Descr. et Iconum*, p. 7, t. 3, fig. 1 (1773); *Thunb., Diss. Rest.*, 17 (1788); *in Usteri, Delect.*, 52 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Willd., Sp. Pl.*, iv, 726 (1806); *Thunb., Fl. Cap.*, ed. 1, p. 333 (1811); ed. *Schultes*, 87 (1823); *Spreng., Syst. Veg.*, i, 185 (1825); *Nees in Linnaea*, v, 640 (1830); *Mast. in Journ. Linn. Soc.*, viii, 243 (1865); *op. cit.*, x, 279 (1868); *op. cit.*, xiv, 417, 418

(1875); *in DC. Monog. Phan.*, i, 277 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 512 (1895); *Mast. in Fl. Cap.*, vii, 84 (1897): var. *gracilis, Nees ex Drège in Linnaea*, xx, 241 (1847): **R. dichotomus,** *Thunb., Diss. Rest.*, 21 !, non *Linn.*, excl. var.; *in Usteri, Delect.*, 55, excl. var.; *Thunb., Prodr. Cap.*, 16, excl. syn. omn.; *ej. Fl. Cap.*, ed. 1, p. 340, excl. syn. omn. et vars. 2 et 3; ed. *Schultes*, 89, excl. syn. *Linn., Rottb.*, et vars. 2 et 3; *Nees in Linnaea*, v, 640, excl. syn. *R. vimineus, Rottb., R. triflorus, Rottb., Thamnochortus dichotomus, Sprengel*; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 40: **Calopsis triticea,** *Kunth, Enum.*, iii, 424 (1841)!; *Steud., Synops.*, ii, 257 (1855): **Restio pannosus,** *Mast. in Journ. Linn. Soc.*, viii, 244!; *in DC. Monog. Phan.*, i, 278; *Durand et Schinz, Consp. Fl. Afr.*, v, 509; *Mast. in Fl. Cap.*, vii, 85: **Hypolaena Bachmannii,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 15 (1900)!.

Stems caespitose, erect, slender, terete, densely studded with whitish, usually flat-topped tubercles (those on the basal parts of the stems are often round-topped and rather prominent), moderately branched or simple, 3–7 dm. high; barren stems generally present in large numbers, much shorter than the flowering, divided into very many filiform branches bearing small subulate-aristate leaf-sheaths; sheaths on the flowering stems closely convolute, elliptic-oblong, acute, aristate, coriaceous, dorsally nervose and tubercled, mostly 1·5–2 cm. long with the awn, with two deciduous, hyaline lobes at the upper margin; male spikelets many or few, in spicate or panicled cymes, oblong or oblanceolate, many-flowered, usually 1–1·5 cm. long; spathe closely embracing the base of the spikelet, sheath-like, ovate-oblong, acute, aristate, about half as long as the spikelet, with two deciduous, hyaline lobes at the upper margin; bracts loosely imbricate, oblong- or occasionally ovate-lanceolate, mucronulate, cartilaginous, narrowly membranous and somewhat lacerate at the margins, mostly 5–8 mm. long, with several conspicuous nerves; perianth subsessile, elliptic-oblong, about 4 mm. long; outer segments lanceolate, cartilaginous; the lateral navicular, acute, slightly villous on the upper half of the carina; the anterior obtuse, dorsally rounded, glabrous; inner segments lanceolate, obtuse, flattened, hyaline; female spikelets many, in spicate or subpanicled cymes, at first lanceolate, becoming elliptic-oblong or elliptic, usually about 5-flowered, 1–1·5 cm. long; spathe and bracts as in the male; perianth stipitate, elliptic, 3·5–4·5 mm. long; outer segments oblong- or occasionally ovate-lanceolate, cartilaginous; the lateral navicular, acute, slightly villous on the upper half or less often on the entire length of the carina; the anterior dorsally rounded, obtuse, glabrous; inner segments ovate-lanceolate, acute or obtuse, united at base, hyaline; ovary obliquely elliptic, 1-celled by abortion; styles 3, separated at base or 2 adjacent and 1 isolated; seeds trigonous, studded with grey tubercles.

South Africa : without precise locality, *Thunberg*, ♂ and ♀, *Sieber*, 106, ♂, 112, ♂ and ♀, *Berg*, ♀, *Drège*, 9451, ♂, *Thom*, 1026, ♂ *Leipold*, ♂.

Cape Province—Cape Div. : Table Mt., *Milne*, 220, ♂, *Drège*, 200, ♂, *Schlechter*, 908, ♂, *R. and T. Fries*, 3084, 3689, ♀ ; north slopes of Table Mt., *Pillans*, 4380, ♂ and ♀, 4381, ♂ and ♀ ; Devil's Peak, *Ecklon and Zeyher*, 1742, ♂, *Bolus*, 4464, ♀, *Wilms*, 3810, ♀ ; Wynberg Hill, *Pillans*, 4386, ♂ and ♀ ; Kirstenbosch, *Page in S.A. Nat. Herb.*, 1021, ♂ ; Orange Kloof, *Wolley-Dod*, 2395, ♂, 2396, ♀ ; False Bay, *Robertson* ; Doornhoogte, *Ecklon and Zegher*, ♂ ; Cape Flats, near Claremont, *Schlechter*, 802, ♂.—Stellenbosch Div. : Sir Lowry's Pass, *Schlechter*, 4818, ♂ and ♀ ; flats between the Strand and Eerste River, *Pillans*, 4910, ♂ and ♀.—Caledon Div. : Donkerhoek Mt., *Burchell*, 8005, ♀ ; Houwhoek, *Schlechter*, 7414, ♂ and ♀ ; Sandfontein, near Klein Zwart Berg, *Schlechter*, 10344, ♂, 10345, ♀ ; Vogel Vley, *Schletcher*, 10487.—Worcester Div. : Du Toit's Kloof, *Tyson*, 862, ♂.—Riversdale Div. : Garcia's Pass, *Bolus*, 16028, ♀ ; Lange Bergen, *Schlechter*, 5674, ♀ ; Phisantefontein, *Muir*, 3189, ♂.—Ladismith Div. : Klein Zwart Berg, *Marloth*, 3654, ♂.—Mossel Bay Div. : Mossel Bay, *Rogers*, 4197, ♀.—George Div. : Silver River, *Schlechter*, 5882, ♀ ; George, *Schlechter*, 2323, ♂.—Knysna Div. : Concordia, *Galpin*, 4793, ♀.—Humansdorp Div. : flats at Witte Els Bosch, *Fourcade*, 1159, ♂ and ♀ ; Assegai Bosch, *Rogers*, 2808, ♀.—Uitenhage Div. : Bethelsdorp, *Paterson*, 345, ♂.—Port Elizabeth Div. : Walmer, *Paterson*, 2366, ♀ ; Earn Cliff, *Galpin*, 6392, ♂.—Albany Div. : without precise locality, *Bolus*, 10660, ♂ ; Grahamstown, *Rogers*, 3858 ; Coldstream, *Daly and Sole*, 254, ♀ ; Stone's Hill, *Whitworth*, ♂ and ♀.—Pondoland : without precise locality, *Bachmann*, 344, ♂.

Klotzsch's " *Restio glumaceus* " in manuscript belongs here.

10. R. strictus, *N. E. Br. in Fl. Cap.*, vii, 752 (1900) !.

Stems caespitose at base, erect, slender, terete, closely marked with minute whitish pits, otherwise smooth, simple, or sparingly branched in the lower part, 3–4 dm. high, about 1 mm. in diameter at the middle ; sheaths closely convolute, ovate or oblong, acuminate, with the midrib produced into a long and slender awn, coriaceous, with very broad hyaline, deciduous margins, reddish, mostly 1–1·5 cm. long without the awn ; awn about 1 cm. long ; male spikelets several or fewer, approximate in short spicate or subpanicled cymes, oblong, tapered in the lower half, many-flowered, 1–1·8 cm. long ; spathe sheath-like, acute, usually with the awn overtopping the spikelet ; bracts loosely imbricate, ovate, acute, mucronate, cartilaginous, 7–8 mm. long ; perianth shortly stipitate, oblong-ovate, 4–5 mm. long ; outer segments oblong-lanceolate, acute, cartilaginous ; the lateral villous-carinate ; the anterior dorsally rounded glabrous ; inner segments lanceolate, acute, shortly united at base, hyaline ; female spikelets like the male but fewer, 4- or 5-flowered ; spathe and bracts as in the male ;

perianth shortly stipitate, oblong-ovate, about 5 mm. long; outer segments as in the male; inner segments as in the male but with involute margins and often bifid at the apex; ovary broadly elliptic, compressed, 2-celled; styles 3, distinct at base; capsule 2-seeded.

South Africa: Cape Province—George Div.: Cradock Berg, *Galpin*, 4795, ♂ and ♀.

11. R. Harveyi, *Mast. in Journ. Linn. Soc.*, viii, 253, t. 15 (1865)!; *in DC. Monog. Phan.*, i, 287 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895); *Mast. in Fl. Cap.*, vii, 91 (1897).

Stems arising from creeping rhizomes, erect, often decumbent at base, slender, terete, rugulose and obsoletely tubercled, much branched, somewhat flexuous, 1–1·5 dm. high; branches filiform, more or less compressed in their lower parts, flexuous; sheaths closely convolute or loose in their upper parts, ovate or ovate-oblong, obtuse or rounded at apex, mucronate, coriaceous, broadly membranous at the margins, dorsally rugulose and obsoletely tubercled, mostly 4–7 mm. long; female spikelets terminal and solitary, broadly ovate, cuneate at base, 2- or 3-flowered, 3–4 mm. long; spathe loosely embracing the base of the spikelet, sheath-like, 2–2·5 mm. long; bracts erect-spreading, ovate, subacute, mucronulate, cartilaginous, membranous at the margins, about 1·75 mm. long; perianth hidden subsessile, elliptic, slightly compressed laterally, 1·5–1·75 mm. long; outer segments oblong, obtuse or rounded at the apex, cartilaginous, sparsely ciliolate at the margins; the lateral navicular, sparsely papillio-ciliate on the reddish keel, pale-membranous at the margins; inner segments oblong-oblanceolate, obtuse and lacerate at the apex, ciliolate at the margins, membranous, equalling or slightly exceeding the outer in length; ovary elliptic, slightly compressed, 2-celled; styles 3, 2 adjacent and 1 isolated, with the inner surface densely villous to the base.

South Africa: Cape Province—Cape Div.: ? near Cape Town, *Harvey*, ♀.

The lateral compression of the female perianth and the very obtuse and ciliolate segments serve to distinguish this species from others having a similar habit of growth.

12. R. zwartbergense, *Pillans*, sp. nov.; culmis filiformibus teretibus tuberculatis valde ramosis; vaginis ovatis vel oblongis acutis aristatis marginibus superioribus late membranaceis; spiculis masculis 2–6 1-floris spicatim cymosis; bracteis paucis elliptico-oblongis acutis mucronatis; perianthio oblongo partim exserto; segmentis elliptico-oblongis acutis glabris; spiculis femineis 1–5 ovatis spicatim cymosis 1-vel raro 2-floris; bracteis ut in mare; perianthio ut in mare trigono; segmentis ut in mare; ovario oblique rotundato biloculari; stylis tribus liberis.

Stems arising from creeping rhizomes, erect, occasionally somewhat decumbent at base, filiform, terete, tubercled, 1–2 dm. high, with many

flexuose branches and branchlets in all parts; sheaths with their persistent portion closely stem-clasping, ovate to oblong, acute, aristate, 4–6 mm. long with the awn on the main stems, coriaceous, scabrid; the upper margins deeply membranous, separating from the midrib and appearing as 2 deciduous lobes; male spikelets 2–6 in a lax spicate cyme, ovate-elliptic, 1-flowered, 2 mm. long; spathe sheath-like but smaller; bracts 2 or 3, closely imbricate, elliptic-oblong, acute, mucronate, cartilaginous, narrowly pale-membranous at the margins, 1–1·5 mm. long; perianth with its upper half exserted beyond the bract, shortly stipitate, oblong, 1·75–2 mm. long; segments elliptic-oblong, acute, glabrous; the outer navicular, cartilaginous; the inner membranous, shorter; female spikelets 1–5 in a lax spicate cyme, ovate, becoming elliptic, 1- or rarely 2-flowered, 3 mm. long; spathe and bracts as in the male; perianth with its upper half exserted beyond the bract, shortly stipitate, elliptic-oblong, trigonous, 2–2·5 mm. long; outer segments elliptic-oblong, acute, navicular, cartilaginous, glabrous; inner segments ovate, acute, cartilaginous, shorter; ovary obliquely rotundate, with 2 cells, one of which is sterile and much smaller than the fertile; styles 3, remote, 2 are sometimes adjacent.

South Africa: Cape Province—Caledon Div.: Zwartberg, *Schlechter*, 5562, ♂ and ♀.

A plant which superficially resembles *R. Eleocharis*, Nees, but is chiefly distinguished by its tubercled stems, 1-flowered male spikelets and 3 styles.

13. R. arcuatus, *Mast. in DC. Monog. Phan.*, i, 247 (1878)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 504 (1895); *Mast. in Fl. Cap.*, vii, 69 (1897).

Stems erect, slender, terete, wrinkled, obscurely tubercled below each node, purple-speckled, much branched from near the base and upwards, 3–5 dm. high; branchlets very slender, often curved; sheaths rather loosely embracing the stem, oblong, subacute or obtuse, mucronate, coriaceous, deeply hyaline-membranous at the upper margins, nervose, mostly 5–10 mm. long; male spikelets solitary or in pairs at the ends of the branchlets, elliptic or oblong-elliptic, several-flowered, 4–6 mm. long; spathes bract-like but mucronate, about half as long as the spikelet; bracts imbricate, ovate, rounded at apex, cartilaginous, membranous at the upper margins, about 3 mm. long; perianth sessile, cuneate, 2 mm. long; outer segments oblong, obtuse, cartilaginous; the lateral navicular, glabrous; inner segments ovate-oblong, obtuse, membranous; female spikelets solitary at the ends of the branchlets, oblong or obovate, 1- or 2-flowered, 4–5 mm. long; spathes as in the male; bracts as in the male but 3–3·5 mm. long; perianth distinctly stipitate, narrowly cuneate, trigonous, 3 mm. long; outer segments linear-oblong, obtuse, cartilaginous, alike, glabrous; the inner linear-oblong, cartilaginous; the lateral subacute; the posterior

obtuse ; ovary obliquely ovate, somewhat compressed, reddish, by abortion 1-celled ; styles 3, free, 2 being adjacent.

South Africa: Cape Province—SWELLENDAM DIV. : on a mountain peak near Swellendam, *Burchell*, 7306, ♂ and ♀ ; Langebergen, near Swellendam, *Schlechter*, 2053, ♂.

14. R. scaberulus, *N. E. Br. in Fl. Cap.*, vii, 751 (1900) !.

Stems usually 8–10 dm. high, stout and rigid in their lower parts, terete, studded with whitish tubercles which are prominent on the outline, from about the middle and upwards producing many much-divided, slender branches ; sheaths on the main stem mostly 2–2·5 cm. long, in the lower half closely embracing the stem, oblong-lanceolate, acute, aristate, coriaceous, tubercled, with broad, membranous margins which are produced at the apex into two lanceolate, acuminate lobes ; sheaths on the branches similar but smaller ; male spikelets several or many, sometimes solitary, in a lax spike or panicle, obovate, cuneate at base, several- or many-flowered, 4–6 mm. long ; spathe oblong-lanceolate, acute, aristate, coriaceous, about equalling the spikelet, with the deeply pale-membranous margins produced at the apex into two lobes such as occur on the sheaths ; bracts clasping the flowers, erect-spreading, ovate, acute with a short, slender, twisted awn, cartilaginous, 3–4 mm. long, with the upper margins deciduous, deeply pale-membranous ; perianth shortly stipitate, elliptic-oblong, 2 mm. long ; outer segments oblong, cartilaginous ; the lateral navicular, acute, minutely villous on the midrib or glabrous ; the anterior obtuse, glabrous ; inner segments oblong-lanceolate, acute, hyaline-membranous ; female spikelets few, in a spike, cuneate, 1- or 2-flowered, about 3 mm. long ; spathe as in the male but rather smaller ; bracts about 3, imbricate, ovate, acute, with a slender, bent mucro, finely lacerate-ciliate at the margins, deeply membranous at apex, 2–3 mm. long ; perianth on a short, minutely pubescent stipe, about half exposed beyond the bract, elliptic, becoming rotundate, 2 mm. long ; outer segments oblong, cartilaginous ; the lateral navicular, acute, minutely pubescent on the midrib or glabrous ; the anterior dorsally rounded, obtuse, glabrous ; inner segments oblong-ovate, subacute, membranous ; ovary orbicular, 2-celled ; styles 3, free, adjacent and swollen at base ; capsule 2-seeded ; seeds obliquely rotundate, smooth.

South Africa: Cape Province—RIVERSDALE DIV. : mountain slopes in Garcia's Pass, *Galpin*, 4789, ♂, *Bolus*, 11394, ♂ ; by the waterfall in Garcia's Pass, *Muir*, 3250, ♂, 3251, ♂, 3252, ♂.—GEORGE DIV. : near the Touw River, *Burchell*, 5732, ♂.

In this species the flowers are occasionally monoecious.

15. R. Stokoei, *Pillans*, sp. nov. ; culmis gracilibus teretibus tuberculatis valde ramosis ; vaginis arcte convolutis ; spiculis masculis solitariis vel germinatis late cuneatis 3–5-floris ; bracteis erecto-patentibus ellipticis obtusis

marginibus laceratis et membranaceis ; perianthio stipitato elliptico-oblongo experto pro parte plurimo ; segmentis exterioribus oblongis, lateralibus villoso-carinatis ; segmentis interioribus ovato-oblongis ; spiculis femineis solitariis elliptico-oblongis 1-vel 2-floris ; bracteis 3 vel 4 imbricatis elliptico-ovatis obtusis , perianthio stipitato elliptico-oblongo experto pro parte ; segmentis exterioribus oblongo-lanceolatis, lateralibus nervo mediano sparse villosis vel glabris ; ovario rotundato biloculari ; stylis 3 liberis.

Stems erect or occasionally decumbent, slender, terete, tubercled, much-branched, 4–5 dm. high ; branches much divided, mostly filiform, tubercled ; sheaths closely convolute, elliptic-oblong, acute, mucronate, coriaceous, externally scabrid, 1–1·5 cm. long on the main stem, with the upper margin produced into two deciduous, membranous lobes ; male spikelets solitary or geminate, broadly cuneate, usually 3–5-flowered, 4–5 mm. long ; spathe ovate, obtuse, mucronate, cartilaginous, broadly membranous at the upper margins, about 3 mm. long ; bracts erect-spreading, elliptic, obtuse, cartilaginous, membranous and lacerate at the margins, 2–2·5 mm. long ; perianth stipitate, for the most part exposed, elliptic-oblong, 2–2·5 mm. long ; outer segments oblong, cartilaginous ; the lateral navicular, acute, villous-carinate ; the anterior obtuse, glabrous ; inner segments ovate-oblong, obtuse, hyaline-membranous ; female spikelets solitary, terminal, elliptic-oblong or cuneate, 1- or 2-flowered ; spathe tightly clasping the spikelet, ovate, acute, subulate-mucronate, cartilaginous, broadly pale-membranous at the margins, about 3 mm. long ; bracts 3 or 4, imbricate, elliptic-ovate, obtuse, mucronate or the upper muticous, cartilaginous, membranous and lacerate at the margins, buff-coloured, about 3 mm. long ; perianth on a stout stipe, with about half of its length protruding beyond the bract, elliptic-oblong, trigonous, 3–3·5 mm. long ; outer segments oblong-lanceolate, cartilaginous ; the lateral acute, with a prominent, glabrous or very sparsely villous midrib ; the anterior obtuse, glabrous ; inner segments ovate, acute, cartilaginous ; ovary rotundate, 2-celled by abortion ; styles 3, free, thickened and united at base to form a stylopodium.

South Africa: Cape Province—Worcester Div. : Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17670, ♂ and ♀.

16. R. Fourcadei, *Pillans*, sp. nov. ; culmis teretibus rugulosis ramosis partibus inferioribus rigidis et paulo robustis ; ramis ramossimis filiformibus ; vaginis arcte convolutis subulato-mucronatis marginibus superioribus late membranaceis ; spiculis masculis paucis spicatim cymosis rotundatis vel orbicularibus 3–5-floris ; bracteis erecto-patentibus ovatis obtusis marginibus anguste membranaceis ; perianthio breviter stipitato elliptico experto pro parte plurimo ; segmentis exterioribus oblongis, lateralibus navicularibus sparse villoso-carinatis ; spiculis femineis solitariis vel paucis spicatim cymosis ellipticis vel late cuneatis 1–4-floris ; bracteis ut in mare ; perianthio

ut in mare sed ampliore; segmentis exterioribus elliptico-oblongis, lateralibus navicularibus nervo medio glabris vel sparse villosis; ovario orbiculari biloculari; stylis tribus liberis.

Stems erect, rather stout and rigid in their lower parts, terete, closely marked with minute, raised, white speckles, apparently about 6 dm. high, producing many much-divided, filiform branches; sheaths on the main stem closely convolute, oblong-elliptic, acute, subulate-mucronate, coriaceous, deeply membranous at the upper margins, usually 2–2·5 cm. long; male spikelets 1–several in a spicate cyme, rotundate or orbicular, cuneate at base, usually 3–5-flowered, about 3 mm. long; spathe ovate, subulate-mucronate, cartilaginous, deeply hyaline-membranous at the upper margins, reaching to about the middle of the spikelet; bracts erect-spreading, ovate, obtuse, cartilaginous, narrowly membranous and lacerate at the margins, about 1·5 mm. long, the lower mucronulate, the upper muticous; perianth shortly stipitate, for the most part exposed, elliptic, 1·5–1·75 mm. long; outer segments oblong, cartilaginous; the lateral navicular, acute, sparsely villous on the slight keel; the anterior flattened, obtuse, glabrous; inner segments oblong, obtuse, hyaline-membranous; female spikelets solitary or few in a spicate cyme, elliptic or broadly cuneate (according to whether the flowers included are respectively 1 or more), 1–4-flowered, 2–4 mm. long; spathe as in the male but equalling or shortly exceeding the spikelet; bracts 2–4 in a spikelet, erect-spreading, ovate, obtuse, cartilaginous, membranous and shortly lacerate at the margins, 1·5–2·5 mm. long; the lower mucronulate, the upper muticous; perianth shortly stipitate, for the most part exposed, elliptic or elliptic-cuneate, subtrigonous, 1·75–2 mm. long; outer segments elliptic-oblong, cartilaginous; the lateral navicular, acute, glabrous or minutely villous on the midrib; the anterior obtuse, glabrous; inner segments ovate-oblong, obtuse, cartilaginous; ovary orbicular, 2-celled; styles 3, free, adjacent at base.

South Africa: Cape Province—George Div.: Montagu Pass, *Schlechter*, 5807, ♂; George, *Sister Stephany in Bolus Herb.*, 17048, ♀.—Humansdorp Div.: mountain slopes above forest, Witte Els Bosch, *Fourcade*, 1221, ♂ and ♀ (type); Blaauw Krantz Pass, *Fourcade*, 2456*b*, ♂.

17. R. quinquefarius, *Nees in Linnaea*, v, 639 (1830)!; *Drege in Linnaea*, xx, 241 (1847); *Steud., Synops. Pl.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 242 (1865); *in DC. Monog. Phan.*, i, 278 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895); *Mast in Fl. Cap.*, vii, 82 (1897); *in Ann. K.K. Natur. Hofmus.*, Band xv, No. 1, p. 10 (1900): **R. xyridioides,** *Kunth, Enum.*, iii, 397 (1841)!.

Stems tufted, erect, slender, terete, rugulose, simple or sparingly branched at the base and upwards, 2–8 dm. high; sheaths closely convolute, oblong, truncate at apex, aristate, coriaceous, dorsally rugulose, about 2 cm. long

without the awn, with a pair of short, brown, membranous lobes at the upper margin; awn foliaceous, linear, scarcely narrowed upwards, dorsally compressed and blunt at apex, about 1 mm. in diameter; male spikelets several or many, in spicate or subpaniculate cymes, oblong or elliptic, many-flowered, 1–2·3 cm. long; spathe sheath-like, usually with the awn overtopping the spikelet; bracts often appearing as arranged in five vertical rows, loosely imbricate, broadly ovate, acute, mucronulate, coriaceous, almost smooth, red-brown, about 5 mm. long; perianth partly exposed at apex, elliptic, 4–5 mm. long; outer segments lanceolate-oblong, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior dorsally rounded, glabrous; inner segments oblong-lanceolate, obtuse, flattened, hyaline-membranous; female spikelets 1–3 in a spicate cyme ovate or elliptic, many-flowered, 1·5–2 cm. long; spathe and bracts as in the male but the latter slightly larger; perianth with most of its upper half exposed beyond the apex and sides of the bract, subsessile, elliptic, about 6 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior dorsally rounded, glabrous; inner segments ovate-lanceolate, acute, dorsally rounded, distinctly narrowed at base, submembranous; ovary elliptic, trigonous, 3-celled, surmounted by a stylopodium; styles 3, free, nude at base; capsule usually 2-seeded by abortion, sometimes 3-seeded.

South Africa: without precise locality, *Oldenburg*, *Laland*, ♂ and ♀, *R. Brown*, ♂, *Forbes*, ♂ and ♀, *Boivin*, 506, ♀, *Harvey*, 372, ♂ and ♀.

Cape Province—Cape Div.: Cape Flats near Rondebosch, *Burchell*, 188, ♂ and ♀, *Schlechter*, 614, 1244, ♀; "Sherwood," Kenilworth, *Bolus*, 16022, ♂; near Wynberg, *Alexander*, ♂ and ♀; Cape Flats at Doornhoogte, *Zeyher*, 564, ♂, 565, ♂ and ♀, 566, ♀; Cape Flats, *Bolus*, 2888, ♀, 4732, ♂, 4760, ♀; False Bay, *Robertson*, ♀; on the Muizenberg, *Moss*, 7842, ♂; near Black River, *Wolley-Dod*, 2711, ♀; Camp's Bay, *Schlechter*, 7831, ♀; flats south-west of Simon's Town, *Pillans*, 2822, ♂ and ♀; Smitswinkel Vley, *Wolley-Dod*, 2675, ♀, 2709, ♀.—Clanwilliam Div.: between Ezelsbank and Dwars River, *Drège*, 35, ♂ and ♀.

18. R. similis, *Pillans in Ann. Bolus Herb.*, iii, 82, tab. v, fig. D (1921).

Stems caespitose, erect, slender, terete, somewhat iridescent, with slightly raised, whitish speckles, moderately branched from near the base and upwards, 2·5–3 dm. high, scarcely 1 mm. in diameter at base; sheaths closely convolute, oblong, obtuse, subulate-mucronate, coriaceous, dorsally nervose, narrowly membranous at the upper margins, red-brown, usually 8–12 mm. long; male spikelets 1–3, in spicate cymes, oblong-elliptic or obovate, obtuse at apex, many-flowered, generally 1–1·2 cm. long; spathes sheath-like, 5–10 mm. long; bracts imbricate, ovate, obtuse, mucronulate, coriaceous, smooth, purple-brown at the upper margin, 4–5 mm. long;

perianth on a short, red stipe, oblong-oblanceolate, compressed, 3·5–4 mm. long; outer segments oblong, obtuse, cartilaginous; the lateral navicular, villous-carinate; the anterior glabrous; inner segments oblong-lanceolate, truncate, hyaline-membranous; female spikelets resembling the male, 1 or 2 in a spicate cyme, elliptic, becoming obovate, 1-flowered, usually 6–7 mm. long; spathes as in the male but smaller; bracts imbricate, ovate-oblong, obtuse, mucronate or mucronulate, coriaceous, smooth, purple-brown at the apex, about 4 mm. long; perianth on a short, red stipe, elliptic-oblong, 3–4 mm. long; outer segments oblong, acute or subacute, cartilaginous; the lateral navicular, villous on the upper half of the carina; the anterior glabrous, shorter; inner segments ovate, acute, membranous; ovary ovate, 3-celled; styles 3, free; capsule 2-seeded by abortion; seeds rotundate, closely studded with grey tubercles.

South Africa: Cape Province—Caledon Div.: Houwhoek, *Schlechter*, 5483, ♀, 7382 partly, ♂ (types).

19. R. miser, *Kunth, Enum.*, iii, 392 (1841)!; *Drège, Zwei Pfl. Docum.*, 82 (1844); *Steud., Synops.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 251 (1865); *in DC. Monog. Phan.*, i, 285 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 89 (1897).

Stems caespitose, erect, slender, terete or occasionally slightly compressed in their lower parts, wrinkled and white-speckled, simple, 2·5–5 dm. high; sheaths tightly convolute, linear-oblong, obtuse, subulate-mucronate, coriaceous, membranous at the upper margins, externally nervose-striate, 1·5–3 cm. long; male spikelets 1–5 in spicate cymes, oblong-ovate, many-flowered, 4–6 mm. long; spathes lanceolate, acute, subulate-mucronate, coriaceous, thinner at the margins, nervose, 6–8 mm. long; bracts imbricate, ovate, subacute, mucronulate, coriaceous, 3 mm. long; perianth sessile, hidden by and equalling its bract, oblong; outer segments linear-oblong, subacute, cartilaginous; the lateral minutely villous on the upper parts of the keel; inner segments lanceolate, subacute, hyaline-membranous, a little shorter; female spikelets resembling the male, 1-flowered; bracts as in the male; perianth sessile, trigonous, 3 mm. long; outer segments lanceolate, acute, cartilaginous; the lateral with a prominent midrib; inner segments lanceolate, acute, cartilaginous, slightly shorter; ovary 3-celled; styles 3; capsule 3-seeded; seeds elliptic, studded with grey tubercles.

South Africa: Cape Province—Worcester Div.: Du Toit's Kloof, *Drège*, 1627, ♂ and ♀.

20. R. stereocaulis, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 1 (1900)!.

Stems caespitose, erect, filiform, compressed, wrinkled, minutely white-spotted, simple or rarely branched, 2–3·5 dm. high, scarcely 1 mm. in

diameter at base; sheaths closely convolute, elliptic-oblong, acute, subulate-mucronate, coriaceous, membranous at the upper margins, nervose, mostly 1–1·5 cm. long; male spikelets many in lax spicate or paniculate cymes, oblanceolate or obovate, about 4-flowered, 4–5 mm. long; spathes bract-like, 3–5 mm. long; bracts closely imbricate, rotundate, rounded and mucronulate at apex, coriaceous, smooth, 2–2·5 mm. long; perianth subsessile, cuneate-oblong, 2·5–3 mm. long; outer segments oblong-lanceolate, acute, navicular, cartilaginous, glabrous, dorsally scabrid; inner segments oblong, subacute, usually bifid at the apex, hyaline-membranous; female spikelets few, occasionally solitary, in spicate or paniculate cymes, ovate, cuneate at base, 1-flowered, 4–5 mm. long; spathes as in the male; bracts closely imbricate, elliptic, obtuse, mucronulate, 1·75–2 mm. long; perianth shortly stipitate, protruding beyond the bracts, elliptic, about 3 mm. long; outer segments oblong-lanceolate, acute, coriaceous; the lateral slightly carinate, glabrous; inner segments ovate-lanceolate, acute, cartilaginous; ovary rotundate, 3-lobed, 3-celled; styles 3, adjacent at base, free; capsule 3- or, by abortion, 1- or 2-seeded; seeds rotundate, studded with grey tubercles.

South Africa: without precise locality, *Thom*, 1024, ♀.

Cape Province—Paarl Div.: mountains at French Hoek, *Schlechter*, 9302, ♂, 9303, ♀.

21. R. debilis, *Nees in Linnaea*, v. 641 (1830)!; *ibid.*, vii, 615 (1832); *Kunth, Enum.*, iii, 412 (1841); *Steud., Synops.*, ii, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 250 (1865); *in DC. Monog. Phan.*, i, 290 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895); *Mast. in Fl. Cap.*, vii, 96 (1897): **Hypolaena subtilis,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 15 (1900)!.

Stems caespitose, erect, slender, terete, wrinkled and with minute white tubercles, 3–4 dm. high, producing many filiform branches from near the base and upwards; sheaths closely convolute, oblong, rounded and subulate-mucronate at apex, coriaceous, narrowly brown-membranous at the margins, dorsally nervose, about 1 cm. long; male spikelets several or many in spicate cymes, at first oblong and erect, becoming obovate and erect-spreading, 2-flowered, 4–5 mm. long; spathe erect, elliptic, obtuse, subulate-mucronate, 4–5 mm. long; bracts loosely imbricate or erect-spreading, ovate-oblong, acute, cartilaginous, narrowly membranous at the upper margins, with a purple-brown patch below the apex, 3–3·5 mm. long; perianth on a short, red stipe, cuneate, trigonous, 3–3·5 mm. long; outer segments oblong, acute, cartilaginous; the lateral somewhat navicular; one with a prominent, shortly pubescent red, median nerve; the other a little shorter, with its median nerve shortly pubescent and red at the apex only; inner segments oblong, acute, hyaline, shorter than the outer;

female spikelets solitary or several, in spicate cymes, oblong or cuneate, 1-flowered, 4–5 mm. long; spathe as in the male; bracts 3 or 4 in a spikelet, loosely imbricate or erect-spreading, broadly oblong, acute or subacute, mucronulate or muticous, cartilaginous, narrowly pale-membranous at the upper margins, 3–3·5 mm. long; perianth on a short, stout stipe, oblong or cuneate-oblong, trigonous, about 4 mm. long; outer segments oblong, acute, cartilaginous; one of the lateral navicular, villous-carinate, the other slightly shorter and shortly pubescent below the apex; inner segments ovate-lanceolate, acute, flattened, membranous; ovary oblong, compressed, 1-celled by abortion; styles 3, free; capsule obliquely obovate.

South Africa: Cape Province—Caledon Div.: Knofloks Kraal, *Zeyher*, ♂; Houwhoek, *Schlechter*, 7553, ♂ and ♀.

In some herbaria Zeyher's plant appears with Sprengel's manuscript name *Thamnochortus debilis*. *Schlechter*, 5934, ♂, from Plettenberg Bay, Knysna Div., may belong here.

Var. β, subulatus (*Pillans*): **Restio subulatus,** *Mast. in Journ. Linn. Soc.*, viii, 248 (1865); *in DC. Monog. Phan.*, i, 281 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 87 (1897): **Hypolaena virgata,** *Mast. in Journ. Linn. Soc.*, x, 268 (1868)!; *in DC. Monog. Phan.*, i, 374; *Durand et Schinz, op. cit.*, 522; *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 16 (1900): **Calorophus virgatus,** *Kuntze, Rev. Gen. Pl.*, pars 2, p. 747 (1891): **H. Browniana,** *Mast. in Fl. Cap.*, vii, 132!: **R. Brownianus,** *Pillans in Ann. Bolus. Herb.*, iii, 85 (1921), excl. syn. *H. subtilis*: slightly larger than the species in all parts. In the female plant the spathes are commonly 8–10 mm. long, the bracts 4 mm. long, the perianth 4·5 mm. long.

Cape Province—Caledon Div.: mountains of Baviaans Kloof, Genadendal, *Burchell*, 7817, ♂; Genadendal, *Drège*, 1613, ♂, *Schlechter*, 10296, ♂, 10297, ♀; Houwhoek, *MacOwan*, 1727, ♂.

In this species and its variety there is considerable difference in shape between those male spikelets which have unopen flowers and those which have open flowers. So great is the change in appearance that it may account for Masters having published species based on plants which differ chiefly in their male spikelets being in different stages of development.

22. R. subtilis, *Nees ex Mast. in Journ. Linn. Soc.*, viii, 251 (1865)!; [*Nees ex Drège in Linnaea*, xx, 240 (1847), nomen]; *Mast. in DC. Monog. Phan.*, i, 282 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 87 (1897).

Stems erect, filiform, somewhat compressed, wrinkled, purple-spotted, simple or in the upper parts sparingly branched, 3–5 dm. high; sheaths closely convolute, oblong, obtuse, coriaceous, smooth or nervose on the upper parts, mostly 1–1·5 cm. long, with the midrib excurrent in a straight mucro; male spikelets few in a terminal spicate cyme or 1 or 2 on short branches

arising from the upper parts of the stems, obovate, tapered at base, 2- or 3-flowered, 2·5–3 mm. long; spathe elliptic-oblong, acute, mucronate, cartilaginous, about as long as the spikelet; bracts imbricate, elliptic, subacute, mucronulate, narrowly membranous at the upper margins, 1·5–2 mm. long; perianth subsessile, elliptic-oblong, about 1·5 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, glabrous; inner segments elliptic-ovate, acute, hyaline-membranous; female spikelets similar to the male but fewer, often solitary, 1-flowered; spathe and bracts as in the male; perianth subsessile, elliptic, 1·5 mm. long; outer segments alike, ovate, acute, cartilaginous, glabrous, dorsally rounded and scabridous; inner segments oblong-lanceolate, acute, membranous, pale; ovary rotundate, 3-lobed, 3-celled; styles 3.

South Africa: Cape Province—Caledon Div.: mountain near Grietje's Gat, between Sir Lowry's Pass and Palmiet River, *Ecklon and Zeyher*, ♂ and ♀.

Masters describes the capsule as being 3-lobed and 3-celled. It is therefore presumably 3-seeded. The seeds he describes as grey.

23. R. depauperatus, *Kunth, Enum.*, iii, 405 (1841)!; *Drège, Zwei Pfl. Documente*, 83 (1844); *Steud., Synops.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 237 (1865); *in DC. Monog. Phan.*, i, 262 (1878); *Durand et Schinz, Consp. Fl. Afr.*, 506 (1895); *Mast. in Fl. Cap.*, vii, 78 (1897).

Stems erect or those at the sides decumbent, filiform, compressed, somewhat keeled on the angles, purple-spotted, 2–4 dm. high, bearing from below the middle and upwards many very slender, flexuose, divided branches; sheaths closely convolute, oblong-lanceolate, subulate-mucronate, coriaceous, membranous at the margins, purple-spotted, mostly 5–10 mm. long on the main stems, often bearing in the axil a partly exserted woolly scale; male spikelets usually 3–6, occasionally solitary or in pairs, in a lax, spicate cyme, elliptic or rotundate, laxly few-flowered, 3–4 mm. long; spathes sheath-like, half to as long as the spikelet; bracts erect-spreading, oblong-ovate, acute, mucronate, cartilaginous, narrowly membranous at the margins, purple-spotted, about 2 mm. long; perianth shortly stipitate, oblong, about 1·75 mm. long; segments lanceolate, acute, membranous, subequal; the outer villous-carinate on the upper half; the remainder glabrous; female spikelets terminal, solitary, cuneate, 1-flowered, about 3 mm. long; spathe as in the male; bracts few, imbricate, ovate, acute, subulate-mucronate, cartilaginous, purple-spotted, about 3 mm. long; perianth shortly stipitate, lanceolate or oblong, trigonous, scarcely 2 mm. long; outer segments lanceolate, acuminate, apiculate, subcarinate, membranous, scabrid near the apex, equal; inner segments linear-lanceolate, acute, hyaline-membranous, slightly shorter; ovary rotundate, 2-celled; styles 3, free; capsule 2- or, by abortion, 1-seeded.

South Africa: without precise locality, *Drège*, 9 partly, ♂.

Cape Province—Paarl Div.: French Hoek Mts., *Drège*, 2021 partly, ♂ and ♀.—Tulbagh Div.: Tulbagh Kloof, *MacOwan in Herb. Austr.-Afr.*, 1672, ♂ and ♀; Tulbagh Waterfall, *Schlechter*, 7517, ♂, 7518, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 10 partly, ♂ and ♀.

24. R. capillaris, *Kunth, Enum.*, iii, 405 (1841)!; *Drège, Zwei Pfl. Documente*, 82 (1844); *Steud., Synops.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 237 (1865); *in DC. Monog. Phan.*, i, 264 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895), excl. distr. omn.; *Mast. in Fl. Cap.*, vii, 79 (1897): **R. perplexus,** var. **gracilis,** *Mast. in DC. Monog. Phan.*, i, 287!; *Durand et Schinz, op. cit.*, 510: **R. implexus,** *Mast. in Fl. Cap.*, vii, 90!.

Stems in small tufts, usually intermingling and forming a tangled growth, erect or the lateral decumbent, very slender, terete, rugulose, white-speckled, sometimes obsoletely tubercled in the upper parts, 3–4 dm. high, with many capillary branches arising from the upper or also the lower nodes; sheaths tightly convolute, oblong, acute, shortly aristate, coriaceous, broadly membranous at the upper margin, mostly 3–5 mm. long; male spikelets several or many, in lax, panicled cymes, elliptic or obovate, 2–6-flowered, 3–5 mm. long; spathe closely embracing the base of the spikelet, aristate, bract-like; bracts loosely imbricate, elliptic or oblong-elliptic, obtuse or subacute, mucronate, cartilaginous, broadly pale-membranous at the margins, about 2 mm. long; perianth partly exposed, shortly stipitate, elliptic-oblong, about 2 mm. long; outer segments linear-oblong, acute, cartilaginous; the lateral navicular, minutely villous on the apical half of the carina; the inner segments linear-oblong, obtuse, membranous; female spikelets terminal and solitary, usually on short branches, elliptic-oblong, tapered at base, 1- or 2-flowered, 4–5 mm. long; spathe bract-like, closely embracing the base of the spikelet, aristate, reaching to about the middle of the spikelet; bracts closely imbricate, elliptic-oblong, acute, mucronate, cartilaginous, broadly pale-membranous at the upper margins, about 3 mm. long; perianth with its apex exposed, stipitate, elliptic-oblong, slightly compressed, about 3 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, glabrous; the lateral navicular, purplish on the apical half of the midrib; the inner segments lanceolate, acute, membranous; ovary rotundate, compressed, 2-celled; styles 3, adjacent at base, free; capsule 2- or, by abortion, 1-seeded.

South Africa: Cape Province—Paarl Div.: Drakenstein Mts., near Bain's Kloof, *Bolus*, 4095, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 339, ♂ and ♀.—Swellendam Div.: base of Lange Bergen, near Swellendam, *Burchell*, 7430, ♂ and ♀.

25. R. perplexus, *Kunth, Enum.*, iii, 406 (1841)!; *Drège, Zwei Pfl.*

Documente, 89 (1844); *Steud., Synops. Pl.*, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 253 (1865); *Mast., op. cit.*, x, 279 (1868); *in DC. Monog. Phan.*, i, 286 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895), excl. var. excl. syn. *R. dichotomus*; *Mast. in Fl. Cap.*, vii, 90 (1897): **R. vimineus,** *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 43 (1875)!: **R. Scopula,** *Mast. in Fl. Cap.*, vii, 96 (1897)!: **R. trichocaulis,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 6 (1900)!.

Stems erect or the lateral decumbent, slender, terete, with many filiform, often flexuous, branches arising from about the middle and upwards, forming a tangled mass of growth, at base sparsely or closely tubercled or nearly smooth, on the upper parts and on the branches wrinkled or tubercled or nearly smooth and grey-speckled, usually 3–6 dm. high; sheaths closely convolute, ovate- or elliptic-oblong, acute, mucronate, coriaceous, nervose, on the main stem mostly 1–1·5 cm. long; the upper margins bearing two deciduous, pale-membranous lobes; male spikelets several or many in lax spicate or panicled cymes, obovate or elliptic, 4–6-flowered, 3–5 mm. long; spathe closely embracing the base of the spikelet, rotundate or orbicular, acute and mucronate at apex, cartilaginous, purple-speckled, broadly membranous at the upper margin, about half as long as the spikelet; bracts rather loosely imbricate, elliptic, obtuse, and mucronate or mucronulate at apex, cartilaginous, purplish, scabridous on the exposed part of the outer surface, broadly pale-membranous at the upper margin, 2–3 mm. long; perianth hidden, shortly stipitate, elliptic-oblong, about 2 mm. long; outer segments narrowly elliptic-oblong, cartilaginous, the lateral navicular, villous-carinate, subacute at apex, the anterior obtuse; inner segments oblong, obtuse, membranous; female spikelets 2 or several in a spicate cyme or panicled, often terminal and solitary on short branchlets, oblong or elliptic-oblong, 1- or occasionally 2-flowered, 4–6 mm. long; spathe closely embracing the base of the spikelet, sheath-like, reaching to about the middle of the spikelet; bracts closely imbricate, ovate or elliptic, cartilaginous, purplish, pale-membranous and obtuse at the upper margin, mucronate, about 4 mm. long; perianth stipitate, exposed at the apex, lanceolate-oblong, obtusely 3-angled, about 4 mm. long; outer segments lanceolate, acute, cartilaginous; the lateral slightly villous on the apical half of its midrib; inner segments ovate-lanceolate, acute, membranous; ovary broadly elliptic, compressed, 2-celled; styles 3, adjacent at base, free; capsule usually 1-seeded by abortion.

South Africa: without precise locality, *Thunberg*, ♂, *Drège*, 8, ♂, *Mund*, ♂.

Cape Province—Cape Div.: Table Mt., *Burchell*, 641, ♀, *Drège*, 339*a*, ♂, *Ecklon*, ♂, *Bolus*, 2886, ♂, 4095*b*, ♀, *Rehmann*, 666, *R. Fries*, ♀; Silver Stream Ravine, *Pillans*, 4384, ♂; summit of Table Mt., *Pillans*, 4387, ♂;

Camps Bay, *Rogers*, 3023, ♂.—CERES DIV.: mountains at Ceres, *Bolus*, 5486, ♂ and ♀, 5489, ♀; Koude Bokkeveld, *Schlechter*, 8877, ♂ and ♀.

26. R. patens, *Mast. in Fl. Cap.*, vii, 97 (1897)!: **R. intricatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 1 (1900)!.

Stems erect, often decumbent at base, slender, terete, tubercled, much branched from near the base and upwards, 3–5 dm. high; sheaths closely convolute, oblong, acute, with a pale, deciduous mucro, coriaceous, deeply hyaline-membranous at the upper margins, externally scabridulous, mostly 5–10 mm. long; male spikelets several or many in lax, spicate or panicled cymes, elliptic-oblong, sometimes becoming obovate, several-flowered, 5–8 mm. long; spathes sheath-like, ovate or ovate-oblong, shorter than the spikelets; bracts loosely embracing the flowers or erect-spreading, ovate-lanceolate, acute, mucronate, cartilaginous, broadly hyaline-membranous at the margins, densely speckled red-brown, 5–6 mm. long; perianth shortly stipitate, elliptic, obtuse at apex, 2·75–3 mm. long; outer segments linear-lanceolate, cartilaginous; the lateral acute, carinate, villous on the upper part of the keel; the anterior dorsally rounded, subacute or obtuse, glabrous; inner segments linear, subacute or obtuse, usually toothed at the apex, membranous, distinctly shorter than the outer; female spikelets 1–4 in spicate or panicled cymes, oblong or elliptic-oblong, 1-flowered by abortion, about 1 cm. long; spathes as in the male; bracts imbricate, oblong-lanceolate, acute, cartilaginous, membranous at the margins, 6–7 mm. long, with a prominent median nerve; perianth stipitate, oblong or oblong-lanceolate, acute at apex, about 5 mm. long; segments oblong-lanceolate, acute, with a prominent midrib, cartilaginous, subequal; the outer lateral slightly carinate, glabrous; the other segments dorsally rounded; ovary oblong-obovate, compressed, rounded at apex, 2-celled by abortion; styles 3, adjacent at base, free, slender; capsule 2-seeded.

South Africa: Cape Province—TULBAGH DIV.: summit of Winterhoek Mt., *Bolus*, 7495, ♂; Great Winterhoek Mt., *Phillips*, 1649, ♂.—CERES DIV.: Skurfde Bergen, near Gydouw, *Schlechter*, 10009, ♀.—CLANWILLIAM DIV.: Cedar Berg, *Primos in Marloth Herb.*, 11790, ♂.

27. R. brachiatus, *Pillans in Ann. Bolus Herb.*, iii, 85 (1921): **Leptocarpus brachiatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 9 (1900)!.

Stems erect, terete, speckled with rudimentary grey tubercles, rigid in the lower parts, slender in the upper, 0·4–1 m. high, sparingly branched above the middle; sheaths closely convolute, ovate-lanceolate, acute or acuminate, subulate-aristate, coriaceous, at first broadly membranous at the upper margins, 2–3 cm. long on the main stems; male spikelets many, in panicled cymes, oblong or ovate-oblong, about 4-flowered, 5–7 mm. long; spathe sheath-like but smaller, about half the length of the spikelet; bracts

loosely imbricate, ovate, acute, mucronate, cartilaginous, dorsally cell-pitted, lacerate and pale-membranous at the margins, 3–4 mm. long; perianth slightly exposed at the apex, stipitate, oblong, about 3 mm. long; segments oblong-lanceolate, acute, membranous; the outer lateral navicular, villous on the upper half of the carina; inner segments hyaline; female spikelets many, in panicled cymes, oblong, tapered at base, 1-flowered, about 1 cm. long; spathe sheath-like but smaller, reaching to about the middle of the spikelet; bracts closely imbricate, ovate or ovate-lanceolate, acute, mucronate, coriaceous, dorsally cell-pitted, at first broadly membranous at the upper margins, about 6 mm. long; perianth with about half of its length exposed beyond the bract, on a short woolly stipe, equally 3-sided, oblong, 7–8 mm. long; segments lanceolate, acute, cartilaginous, glabrous; the outer lateral dorsally rounded in the lower half, slightly keeled on the upper; ovary elliptic, purple, 2-celled; styles 3, nude and adjacent at base, free; capsule rotundate, compressed, 2-seeded.

South Africa: Cape Province—Tulbagh Div.: Great Winterhoek, *Phillips*, 1647, ♀.—Ceres Div.: Koude Bokkeveld, Gydouwberg, *Schlechter*, 10228, ♂, 10229, ♀.

28. R. cymosus, *Pillans in Ann. Bolus Herb.*, iii, 85 (1921): **Leptocarpus cymosus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 10 (1900) !.

Stems erect, terete, closely studded with minute grey tubercles, rigid in the lower parts, slender in the upper, 0·5–1·6 m. high, about 2 mm. in diameter at the middle, with several virgate branches in the upper parts; sheaths closely convolute, ovate-lanceolate, acuminate, subulate-aristate, coriaceous, nervose, at first broadly membranous at the upper margins, mostly 2–3 cm. long on the main stems; male spikelets many, in panicled or less often in spicate cymes, ovate-oblong, about 5-flowered, 5–8 mm. long; spathe sheath-like, about half the length of the spikelet; bracts loosely imbricate, ovate, acute, mucronulate, cartilaginous, dorsally cell-pitted, pale-membranous at the margins, about 3·5 mm. long; perianth partly exposed beyond the bract, shortly stipitate, elliptic-oblong, about 3 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, minutely villous on the upper half of the carina; the anterior dorsally rounded, glabrous; inner segments oblong-lanceolate, obtuse and dentate at apex, hyaline-membranous; female spikelets many, in panicled cymes, oblong or ovate-oblong, 1–3-flowered, 7–9 mm. long; the whole inflorescence usually 7–10 cm. long; spathe as in the male; bracts closely imbricate, ovate, acute, mucronate, coriaceous, dorsally cell-pitted, pale-membranous at the margins, about 4 mm. long; perianth with ½ or ⅓ of its upper part exposed beyond the bract, on a short, woolly stipe, oblong-lanceolate, almost equally 3-sided, 4·5–5 mm. long; segments lanceolate, acute, cartilaginous, glabrous; the outer lateral slightly keeled; the inner

membranous at the margins; ovary elliptic, 2-celled, purple; styles 3, adjacent and nude at base, free; capsule 2-seeded.

South Africa: Cape Province—CERES DIV.: Koude Bokkeveld, *Schlechter*, 8865, ♂, 8866, ♀.—LITTLE NAMAQUALAND: Kamiesberg, *Pearson in Sladen Mem. Exped.*, 6351, ♀.

29. R. occultus, *Pillans*, comb. nov.: **Thamnochortus occultus,** *Mast. in Fl. Cap.*, vii, 130 (1897)!: **Hypolaena Schlechteri,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 15 (1900)!: **Restio Schlechteri,** *Pillans in Ann. Bolus Herb.*, iii, 85 (1921).

Stems erect, 7–10 dm. high, about 2 mm. in diameter at the middle, terete, closely studded with small grey tubercles, with a few virgate branches on the upper parts; sheaths closely convolute, oblong-lanceolate, acuminate, subulate-aristate, coriaceous, white-membranous at the margins, dorsally nervose, purplish and grey-spotted, mostly 3–4 cm. long on the main stem; male spikelets many, in panicled or spicate cymes, oblong, about 6-flowered, 1–1·3 cm. long; spathe ovate, acute, subulate-mucronate, coriaceous, reaching to about the middle of the spikelet, with deciduous, pale-membranous upper margins; bracts rather loosely imbricate, oblong-lanceolate, acute, mucronate, cartilaginous, white-membranous at the margins, dorsally scabridous and purple-brown, 6–7 mm. long; perianth shortly stipitate, oblong, 3·5–4 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, villous on the upper half of the carina; the anterior dorsally rounded, glabrous; inner segments linear-lanceolate, subacute and minutely toothed at the apex, hyaline-membranous; female spikelets many, in panicled cymes, oblong, 5–9-flowered, 1–2 cm. long; spathe ovate, acute, aristate, coriaceous, membranous at the margins, reaching to about the middle of the spikelet; bracts loosely imbricate, oblong- or ovate-lanceolate, acute or acuminate, subulate-mucronate or aristate, cartilaginous, white-membranous at the margins, dorsally scabridous, purplish, mostly 1–1·5 cm. long; perianth partly exposed at the side of the bract, stipitate, oblong-lanceolate, 5–6 mm. long; outer segments lanceolate, acute, cartilaginous; the lateral villous-carinate; the anterior dorsally rounded, glabrous; inner segments lanceolate, subacute, narrowed and shortly united at base, bifid or minutely toothed at the apex, hyaline-membranous; ovary elliptic, compressed, 2-celled; styles 3, adjacent and nude at base.

South Africa: Cape Province—PAARL DIV.: pass above French Hoek, *Pickstone*, 3, ♂.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 1612, ♂.—CLANWILLIAM DIV.: Ezelbank, *Schlechter*, 8833, ♂, 8834, ♀.—LITTLE NAMAQUALAND: Rood Berg, *Drège*, 6, ♂.

30. R. filiformis, *Poir. in Lam., Encycl. Meth.*, vi, 173 (1804)!; *Pers., Syn. Pl.*, ii, 606, sub *R. bifidus* (1807); *Mast. in Fl. Cap.*, vii, 86 (1897):

R. triflorus, *Thunb., Diss. Rest.*, 16 (1788) !, non *Rottb.* ; *in Usteri, Delect.*, 51 (1790) ; *Thunb., Prodr. Cap.*, 15 (1794) ; *Willd., Sp. Pl.*, iv, pars 2, p. 724 (1806), excl. syn. *Rottb.* ; *Thunb., Fl. Cap.*, ed. 1, p. 330 (1811), excl. syn. *Rottb.* ; ed. *Schultes*, 86 (1823), excl. syn. *Rottb.* ; *Spreng., Syst. Veg.*, i, 185 (1825) ; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 417 (1875) : **R. monostachyus,** *Steud. in Flora*, 1829, i, 133 ! : **R. bifidus,** *Nees in Linnaea*, v, 636 (1830) !, non *Thunb.*, excl. syn. *Thunb.* ; *Kunth, Enum.*, iii, 409 (1841), excl. syn. *Pers.* ; *Steud., Synops. Pl.*, ii, 250 (1855), non *Thunb.* ; *Mast. in Journ. Linn. Soc.*, viii, 253 (1865), non *Thunb.* : **R. Garnotianus,** *Kunth, Enum.*, iii, 392 ! ; *Drège, Zwei Pfl. Documente*, 79 (1844) ; *Steud., op. cit.*, 251 ; *Mast. in Journ. Linn. Soc.*, viii, 254 ; *in DC. Monog. Phan.*, i, 280 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 507 (1895), incl. vars. : **R. oligostachyus,** *Kunth, op. cit.*, 399 ! ; *Drège, op. cit.*, 122 ; *Steud., op. cit.*, 252 : **R. bifidus,** var. β, *Kunth, op. cit.*, 409 ! : **Craspedolepis Verreauxii,** *Steud., op. cit.*, 264 ! : **R. Garnotianus,** *Kunth*, var. **monostachyus,** *Steud. ex Mast. in DC. Monog. Phan.*, i, 281 ! ; **R. Garnotianus,** *Kunth*, var. **oligostachyus,** *Mast., loc. cit.* ! : **R. filiformis,** *Poir.*, vars. β, **oligostachyus,** γ, **monostachyus,** *Mast. in Fl. Cap.*, vii, 86 ! : **R. multicurvus,** *N. E. Br. in Fl. Cap.*, vii, 751 (1900) !.

Stems caespitose, erect, filiform, terete, slightly rough with obsolete tubercles, white-speckled, simple or sparingly branched, usually 2–4 dm. high ; sheaths closely convolute, oblong, rounded at the upper end, subulate-mucronate, coriaceous, membranous at the upper margin, mostly about 1 cm. long ; male spikelets few or many, in spicate or panicled cymes, oblong or obovate, many-flowered, about 1 cm. long ; spathe closely embracing the base of the spikelet, rotundate or orbicular, subulate-mucronate, coriaceous, reaching to about the middle of the spikelet ; bracts elliptic, obtuse and shortly mucronate at apex, cartilaginous, narrowly membranous at the upper margins, cell-pitted and red-brown on the upper half of the outer surface, 4–5 mm. long ; perianth shortly stipitate, elliptic-oblong, about 3·5 mm. long ; outer segments oblanceolate-oblong, acute, cartilaginous ; the lateral navicular, villous-carinate ; inner segments oblong-lanceolate, obtuse, hyaline ; female spikelets 1–3 in a spicate cyme, elliptic, oblong-elliptic or obovate, 3–5-flowered, about 1 cm. long ; spathe and bracts as in the male but the latter usually larger, up to 7 mm. in length ; perianth partly exposed at the apex, shortly stipitate, ovate, acute, at apex, about 5 mm. long ; outer segments lanceolate, acute, cartilaginous ; the lateral navicular, densely villous on the carina ; the anterior slightly villous at its apex ; inner segments ovate-lanceolate, acute, with involute margins, more or less united at base, membranous ; ovary rotundate, compressed, 2-celled ; styles 3, adjacent and nude at base, free ; capsule 2- or, by abortion, 1-seeded ; seeds rotundate, studded with minute grey tubercles.

South Africa : without precise locality, *Thunberg*, ♀, *Berg*, ♀, *Boivin*, 496, ♂, *Verreau*, ♀, *Drège*, 59, ♂.

Cape Province—Cape Div. : Table Mt., *Burchell*, 925, *Ecklon*, 840, ♂, *Milne*, 218, ♂, *Drège*, 197, ♀, *MacGillivray*, 436, ♂ ; near Cape Town, *Bolus*, 2887, ♂ ; Devil's Peak, *Wilms*, 3808, ♂ ; Constantia Berg, *Schlechter*, 1459, ♂ ; Steenberg, *Pillans*, 3128, ♂ and ♀ ; hills at source of Silver Mine Stream, *Pillans*, 4378, ♂ and ♀ ; Simon's Berg, *Wolley-Dod*, 2802, ♂ ; Cape Flats, *Pappe*, ♂.—Stellenbosch Div. : Sir Lowry's Pass, *Schlechter*, 4813, ♂, 7238, ♂, 7259, ♀.—Caledon Div. : mountains of Baviaans Kloof, Genadendal, *Burchell*, 7647, ♀ ; Steenbras, *Rogers*, 11060, ♀ ; Houwhoek, *Schlechter*, 7344, ♂, 7382 partly, ♂ ; Zwart Berg, *Zeyher*, 4343, ♂ and ♀, *Schlechter*, 5585, ♂ ; between Villiersdorp and French Hoek, *Bolus*, 7490, ♂.—Paarl Div. : French Hoek, *Pickstone*, 2, ♂, 3, ♂.—Piquetberg Div. : Piqueniers Kloof, *Schlechter*, 7952, ♂.—Tulbagh Div. : near Tulbagh Waterfall, *Ecklon and Zeyher*, ♀ ; Tulbagh Kloof, *MacOwan in Herb. Austr.-Afr.*, 1668, ♂.—Ceres Div. : Ceres, *Bolus*, 5292, ♂ ; Vaalkloof, near Karroopoort, *Marloth*, 9111, ♂.—Clanwilliam Div. : Ezelsbank, Cedarberg, *Drège*, 2473, *Primos in Marloth Herb.*, 11785, ♂, 11786, ♂ ; Blauw Berg, *Schlechter*, 8441, ♂, 8442, ♀.—Worcester Div. : Worcester, *Ecklon and Zeyher*, ♀ ; Du Toit's Kloof, *Drège*, 84 partly, ♀, 1624, ♀, 1628*a*, ♂, 1631.—Riversdale Div. : Garcia's Pass, *Galpin*, 4785, ♂, *Bolus*, 11393, ♂.—Knysna Div. : the Glebe, *Galpin*, 4796, ♂.—Uniondale Div. : between Welgelegen and Onzer, *Drège*, 37 partly, ♀.

31. R. bifurcus, *Nees ex Mast. in Journ. Linn. Soc.*, viii, 247 (1865) ! ; [*Nees ex Drège in Linnaea*, xx, 241 (1847) !, nomen] ; *Mast. in DC. Monog. Phan.*, i, 275 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895), excl. hab. omn. : **R. furcatus,** *Mast. in Fl. Cap.*, vii, 83 (1897) !, non *Nees*, quoad pl. masc., partim, pl. fem. omn.

Stems tufted, erect, slender, occasionally rigid and comparatively stout in the lower parts, terete or somewhat compressed when living, usually furrowed by shrinkage when dried, often rugulose on the lower parts, grey-speckled, simple or sparingly branched, 3–9 dm. high ; sheaths closely convolute, elliptic-oblong or ovate, acute, or acuminate, mucronate, coriaceous, nervose, at first broadly membranous at the upper margins, mostly 1·5–2·5 cm. long on the main stems ; male spikelets many or several, respectively in panicled or spicate cymes, elliptic or ovate, many-flowered, 1–1·5 cm. long ; spathe tightly embracing the base of the spikelet, sheath-like, scarcely reaching to the middle of the spikelet ; bracts closely adpressed to the flowers, rotundate or orbicular, obtuse, mucronate or mucronulate, 5–6 mm. long, cartilaginous, nervose, with a pitted and brown-membranous band round the upper margin ; perianth exposed in its upper part, stipitate, oblong-elliptic, about 5 mm. long ; outer segments oblong-

lanceolate, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior with its midrib villous on the upper half; inner segments lanceolate, acute, membranous; female spikelets many, in panicled cymes, elliptic, becoming rotundate with fruiting, tapered at base, about 4-flowered, 1–1·5 cm. long; spathe and bracts as in the male but the latter rotundate and larger; perianth partly exserted beyond the bract, stipitate, ovate or elliptic, 5–6 mm. long; outer segments oblong, acute, cartilaginous; the lateral navicular, conspicuously villous-carinate; the anterior villous on the upper half of its midrib; inner segments ovate-lanceolate, acute, for the most part cartilaginous, membranous at the margins; ovary ovate, compressed, 2-celled, surmounted by a short stylopodium; styles 3, adjacent at base, free; capsule 2- or, by abortion, 1-seeded; seeds smooth, grey.

South Africa: without precise locality, *Masson*, ♂, *Thom.*

Cape Province—Cape Div.: Cape Flats, *Zeyher*, ♂, *Bolus*, 4452, ♀; Diep River, *Wolley-Dod*, 2600, ♂; flats north-east of the Steenberg, *Pillans*, 3569, ♂ and ♀; Simon's Town Mts., *Robertson*, ♀, *Ecklon and Zeyher*, ♂ and ♀; Smitswinkel Vley, *Wolley-Dod*, 2674, ♂.—Stellenbosch Div.: Kraaifontein, *Marloth*, 3181, ♀.

32. R. praeacutus, *Mast. in Fl. Cap.*, vii, 84 (1897) !.

Stems erect, slender, terete, obsoletely tubercled, sparingly branched, 6–9 dm. high; sheaths closely convolute, oblong, acute at the apex of the thicker portion, subulate-mucronate, coriaceous, membranous at the upper margins, dorsally nervose, deciduous in the upper parts, mostly 1·5–2 cm. long on the main stems; " male spikelets 5–7, in an erect, panicled cyme, each spikelet linear-ovoid, acute, subtended by a bract-like spathe, ⅓ shorter than the spikelet; bracts loosely imbricate, coriaceous, pitted near the apex; flowers pedicellate; outer perianth-segments rigid, lanceolate, acute; lateral villous-carinate; intermediate flat, cartilaginous, thickened at the apex and near the base; inner slightly shorter than the outer, lanceolate, thickened at the base ", (Masters); female spikelets many or several, respectively in panicled or spicate cymes, obovate or elliptic, several-flowered, 1–1·5 cm. long; spathe sheath-like, ovate or elliptic, with deciduous, membranous upper margins, mucronate, scarcely reaching to the middle of the spikelet; bracts loosely imbricate, elliptic, subacute, mucronate, cartilaginous, narrowly pale-membranous at the margins, smooth on the lower parts, pitted and purple-brown on the upper, 6–7 mm. long; perianth with its upper parts and one side partly exposed, on a cuneate stipe, ovate or elliptic, about 5 mm. long; outer segments lanceolate, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior dorsally rounded, glabrous; inner segments ovate-lanceolate, subacute or obtuse, submembranous; ovary rotundate, compressed, 2-celled by abortion, purple;

styles 3, rarely 4, arising from a short stylopodium, free ; capsule orbicular, 2-seeded.

South Africa: Cape Province—Malmesbury Div. : Hopefield, *Bolus*, 12896, ♀.—Van Rhynsdorp Div. : Gift Berg, *Drège*, 88, ♀.

Other collectings which may belong here are—Caledon Div. : Genadendal, *Drège*, 1608 partly, ♀, *Schlechter*, 10302, ♀.—Worcester Div. : Du Toit's Kloof, *Drège*, 46 partly, ♀.

Among the distinguishing characters of this species mentioned by Masters is the presence of a disc which, however, I have not been able to trace in the material examined by me.

33. R. Bolusii, *Pillans*, sp. nov. ; culmis teretibus sublaevibus, basi rigidis, partibus superioribus gracilibus ramosis ; vaginis arcte convolutis acutis mucronatis, marginibus superioribus late membranaceis ; spiculis masculis 1–3 in spicatam cymam dispositis ovatis vel ellipticis pluri-floris ; bracteis arcte imbricatis rotundatis vel orbicularibus mucronatis vel muticis, margine auguste membranaceis ; perianthio stipitato-elliptico ; segmentis exterioribus lineari-lanceolatis acutis membranaceis ; spiculis femineis bracteisque ut in mare sed majoribus ; perianthio stipitato elliptico apice experto ; segmentis exterioribus oblongo-lanceolatis acutis, lateralibus navicularibus villoso-carinatis ; segmentis interioribus lanceolatis acutis ; ovario orbiculari compresso biloculari ; stylis tribus basi connatis.

Stems erect, rigid in their lower parts, producing from about the middle and upwards several or many slender, divided branches, terete, nearly smooth, minutely yellow-speckled, 3–8 dm. high, about 3 mm. in diameter in their lower parts ; sheaths closely convolute, ovate or oblong-ovate, acute, subulate-mucronate, coriaceous, with deciduous, broadly membranous upper margins, nervose, mostly 1·5–2·5 cm. long ; male spikelets 1–3 in a spicate cyme, ovate, elliptic or subrotund, obtuse at apex, many-flowered, about 1 cm. long ; spathe closely embracing the base of the spikelet, rotundate or orbicular, acute, stoutly and shortly mucronate, coriaceous, about half as long as the spikelet, with the upper margin broadly membranous and deciduous ; bracts closely imbricate, rotundate or orbicular, obtuse or rounded at apex, coriaceous, narrowly membranous at the upper margins, nervose, about 4 mm. long ; the lower shortly and stoutly mucronate, the upper mucronulate or muticous ; perianth with about ⅓ of its upper part exposed, stipitate, elliptic, 4–5 mm. long ; outer segments oblong-lanceolate, acute, cartilaginous ; the lateral navicular, villous-carinate ; the anterior dorsally rounded, glabrous ; inner segments linear-lanceolate, acute, membranous ; rudimentary ovary raised upon a gynophore ; female spikelets 1–3 in a spicate cyme, obovate or elliptic, subacute at apex, many-flowered, 1·5–2 cm. long ; spathe as in the male ; sterile bracts about 3, slightly smaller than the fertile ; fertile bracts closely

imbricate, rotundate, obtuse or rounded at apex with a short, stout mucro, coriaceous, nervose, pale-membranous at the upper margin, 6–8 mm. long; perianth exposed at the apex, elliptic, 6–8 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, the lateral navicular villous-carinate, the anterior dorsally rounded, glabrous; inner segments lanceolate, acute, submembranous; ovary orbicular, compressed, with an anterior vertical ridge, 2-celled; styles 3, shortly united at base; capsule 2-seeded; seeds elliptic, trigonous, studded with oblong, grey tubercles.

South Africa: Cape Province—Caledon Div.: Genadendal, *Bolus*, 7431, ♂ and ♀ (type), *Schlechter*, 9880, ♂.—Worcester Div.: Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17664, ♂ and ♀.

The affinity of this species is with **R. strobilifer,** Kunth, from which it differs chiefly in its stouter stems, broader mucronate bracts, and larger female perianth.

34. R. strobilifer, *Kunth, Enum.*, iii, 398 (1841)!; *Drège, Zwei Pfl. Documente*, 74 (1844); *Steud., Synops. Pl.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 242 (1865); *in DC. Monog. Phan.*, i, 282 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 88 (1897): **R. sparsus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 2 (1900)!.

Stems caespitose, erect, slender, terete, scabridous, with minute, slightly raised, whitish speckles, sparingly branched, 6–9 dm. high, about 1 mm. in diameter at the middle; sheaths closely convolute, oblong or elliptic-oblong, acute, subulate-mucronate, coriaceous, nervose, ferruginous, yellow-speckled, mostly 1·5–2 cm. long, with the upper margins deciduous, at first broadly pale-membranous; male spikelets 1–4 in a spicate cyme, stipitate, ovate or elliptic, terete, acute at apex, many-flowered, usually 1·3–1·6 cm. long; spathe bract-like; bracts closely imbricate, broadly obovate or broadly elliptic, rounded at apex, muticous, cartilaginous, narrowly membranous at the upper margins, nervose, 4–5 mm. long; perianth shortly stipitate, slightly exposed at the apex, elliptic oblong or oblanceolate, much compressed, 4–4·5 mm. long; outer segments acute, cartilaginous; the lateral navicular, oblong, villous-carinate; the anterior linear-oblong, glabrous; inner segments for the most part cartilaginous, membranous at the margins and apex; the lateral linear-oblong, acute; the posterior oblanceolate-oblong, obtuse; female spikelets terminal and solitary or 2 in a spicate cyme, as in the male or slightly larger; spathe and bracts as in the male but the latter broadly elliptic and commonly attaining 8 mm. in length; perianth stipitate, slightly exposed at the apex, elliptic, about 5 mm. long; segments lanceolate, acute, cartilaginous; the outer lateral navicular, villous-carinate; the anterior and inner glabrous; ovary rotundate, compressed, 2-celled; styles 3, shortly united at base; capsule 2- or, by abortion, 1-seeded; seeds rotundate, smooth.

South Africa: without precise locality, *Verreaux*, ♂.

Cape Province—CERES DIV.: mountains round Ceres, *Bolus*, 5484, ♂, 8325, ♂ and ♀; Mitchell's Pass, *Schlechter*, 9957, ♂.—CLANWILLIAM DIV.: Cedarberg, at Ezelsbank, *Drège*, 2474, ♂ and ♀; Cedarberg, *Primos in Marloth Herb.*, 11794, ♂.—WORCESTER DIV.: Fonteinjesberg, *Stokoe in Bolus Herb.*, 18378, ♂.

35. R. pachystachyus, *Kunth, Enum.*, iii, 399 (1841)!; *Drège, Zwei Pfl. Documente*, 73 (1844); *Steud., Synops. Pl.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 242 (1865); *in DC. Monog. Phan.*, i, 283 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 88 (1897): **R. furcatus,** *Nees ex Mast. in Journ. Linn. Soc.*, viii, 242!; *in DC. Monog. Phan.*, i, 275: **R. dimorphostachyus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 2 (1900)!.

Stems caespitose, erect, wiry, terete, obsoletely tubercled or punctate, moderately or sparingly branched, occasionally simple, 4–10 dm. high; sheaths closely convolute in their persistent portion, elliptic-ovate or elliptic-oblong, acute, aristate, coriaceous, often obscurely tubercled on the base, nervose below the apex, for the most part red-brown, purple at the apex, grey-speckled, mostly 1·5–2·5 cm. long on the main stems with the awn; the upper margins deciduous, deeply membranous, lacerate or separated from the midrib and appearing as a pair of lobes; male spikelets 1 to several in a spicate cyme or many in a paniculate cyme, ovate, many-flowered, 1–1·5 cm. long; spathe closely embracing the base of the spikelet, elliptic or rotundate, obtuse or acute, mucronate, coriaceous, 5–7 mm. long with a deciduous, membranous upper margin; sterile bracts at the base of the spikelet many; fertile bracts closely imbricate, elliptic or rotundate, acute, mucronate, cartilaginous, with deciduous, narrowly membranous upper margins, ferruginous, dark chestnut-brown at the apex, 4·5–7 mm. long; perianth shortly stipitate, elliptic, 3·5–5 mm. long; outer segments oblong, acute, cartilaginous; the lateral navicular, densely villous on the entire length of the carina; inner segments acute, toothed at the apex, hyaline-membranous, much shorter; the lateral oblong; the posterior broadly oblong; female spikelets solitary or in pairs, elliptic or ovate, many-flowered, 1·5–2·5 cm. long; spathe as in the male but slightly larger; bracts closely imbricate, becoming rather loose, ovate-elliptic, acute, with a rather stout, erect-spreading mucro, coriaceous, dark chestnut-brown on the apex and mucro, 9–13 mm. long, with deciduous narrowly membranous upper margins; perianth slightly exposed at its apex, shortly stipitate, ovate, about 6 mm. long; segments lanceolate, acute, cartilaginous; the outer lateral navicular, densely villous on the entire length of the carina; ovary rotundate, 2-celled; styles 3, adjacent, free; capsule 2-seeded; seeds elliptic, obtusely 3-angled, closely covered with small grey tubercles.

South Africa: without precise locality, *Ecklon and Zeyher*, ♂.

Cape Province—Caledon Div.: Zwartberg, *Schlechter*, 9788, ♂, 9789, ♀, *Pillans in Bolus Herb.*, 17700, ♂.—Paarl Div.: Drakenstein Mts., near Bain's Kloof, *Bolus*, 4093, ♀; Bain's Kloof, *Schlechter*, 9164, ♀.—Clanwilliam Div.: Wupperthal, *Drège*, 43, ♀.

36. R. brunneus, *Pillans*, sp. nov.; culmis simplicibus vel sparse ramosis teretibus filiformibus sublaevis; vaginis arcte convolutis ovato vel oblongo-lanceolatis aristatis coriaceis marginibus superioribus membranaceis; spiculis masculis late ellipticis vel rotundatis apice obtusis paniculatim cymosis; bracteis late ellipticis acutis mucronatis; perianthio elliptico-oblongo; segmentis exterioribus acutis, lateralibus oblongis villoso-carinatis; interioribus elliptico-oblongis apice obtusis dentatis; spiculis femineis late ovatis vel rotundatis plurifloris spicatim vel paniculatim cymosis; bracteis arcte imbricatis rotundatis mucronatis; perianthio elliptico; segmentis oblongo-lanceolatis acutis, exterioribus lateralibus villoso-carinatis; ovario rotundato biloculari; stylis duobus liberis.

Stems erect, simple or sparingly branched, terete, slender, finely wrinkled and puncticulate, about 5 dm. high, 1·5–1·75 mm. in diameter at the middle; sheaths closely convolute, ovate or oblong-lanceolate, acute, aristate, coriaceous, pale-membranous at the upper margins, nervose, dark brown, grey-speckled, mostly 2–2·5 cm. long; male spikelets many, in lax panicled cymes, stipitate, broadly elliptic or rotundate, obtuse at apex, terete, many-flowered, 1–1·5 cm. long; spathe sheath-like but smaller, scarcely reaching to the middle of the spikelet; bracts closely imbricate, broadly elliptic, acute, stoutly mucronate, cartilaginous, nervose, cinnamon-brown, brown-membranous at the upper margins, 6–7 mm. long; perianth subsessile, elliptic-oblong, much compressed, 4·5–5 mm. long; outer segments cartilaginous, acute; the lateral navicular, oblong, villous-carinate; the anterior linear-oblong; inner segments elliptic-oblong, obtuse and toothed at the apex, hyaline-membranous, distinctly shorter than the outer; female spikelets several, in lax spicate or panicled cymes, stipitate, broadly ovate or rotundate, many-flowered, 1·5–1·8 cm. long; spathe sheath-like, less than half as long as the spikelet; bracts closely imbricate, rotundate, acute, about 7·5 mm. long, with a somewhat spreading mucro, cartilaginous, cinnamon-brown, with the upper margins brown-membranous and deciduous; perianth sessile, elliptic, much compressed, 5–6 mm. long; segments oblong-lanceolate, acute, cartilaginous; the outer lateral navicular, villous-carinate; the anterior externally rounded, glabrous; the inner slightly shorter; ovary rotundate, compressed, 2-celled; styles 3, adjacent at base, free; capsule 2- or 1-seeded by abortion.

South Africa: Cape Province—without precise locality, *Marloth*,

4793, ♀, 11795, ♂.—Clanwilliam Div.: Cedarberg, *Barnard in Herb. Mus. Austr.-Afr.*, 33082, ♂.

37. R. festucaeformis, *Nees ex Mast. in Journ. Linn. Soc.*, viii, 248 (1865)!; *Mast. in DC. Monog. Phan.*, i, 281 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 507 (1895); *Mast. in Fl. Cap.*, vii, 87 (1897).

Stems erect, slender, often filiform in the upper parts, terete or slightly compressed, rugulose or obscurely tubercled, usually 4–6 dm. high, with one virgate, long branch from each of the middle and upper nodes; sheaths closely convolute, lanceolate, acute, coriaceous, cartilaginous at the margins, externally nervose-striate, straw-coloured, mostly 2·5–3 cm. long, with a compressed, erect awn; male spikelets many in a rather dense panicle, linear-oblong, tapered at base, many-flowered, straw-coloured, shiny, 1–1·5 cm. long; spathes and spathellae like the upper sheaths but cartilaginous and smaller; bracts loosely imbricate, long-decurrent at base, oblong-lanceolate, acute or acuminate, mucronulate, chartaceous, 6–9 mm. long; perianth on a slender, red stipe, partly exposed, obliquely elliptic-oblong, about 2·5 mm. long; outer segments oblong-lanceolate, obtuse, membranous; the lateral slightly carinate, minutely puberulous or glabrous on the keel; the anterior dorsally rounded, glabrous; inner segments linear-lanceolate, acute, hyaline; female inflorescence like the male; spikelets resembling the male, 5- or 6-flowered; bracts looser and slightly larger than in the male, otherwise agreeing with them; perianth on a cuneate stipe, partly exposed, obliquely elliptic, 2·5–3 mm. long; outer segments oblong-lanceolate, obtuse, membranous, minutely puberulous on the outer surface; lateral segments unequal, one navicular and sharply carinate, glabrous on the keel, the other straight, dorsally rounded; inner segments lanceolate, acute, bifid at apex, membranous; ovary ovate, compressed, 2-celled, red, soft, and pale at the angles; styles 3, adjacent at base, free, very slender; capsule 2-seeded.

South Africa: Cape Province—Caledon Div.: Zwart Berg, near Caledon, *Ecklon and Zeyher*, ♂ and ♀; Houwhoek, *Schlechter*, 5497, ♀, 7788, ♂, *L. Bolus in Bolus Herb.*, 18458, ♂ and ♀.

In several of the old herbaria this plant has been named "*Restio ischaemoides*" by Nees in manuscript.

38. R. Dodii, *Pillans in Ann. Bolus Herb.*, iii, 85 (1921): **Hypolaena membranacea,** *Mast. in Eng. Bot. Jahrb.*, xxix, Beibl. 66, p. 14 (1900)!.

Plants occasionally monoecious; stems erect, rigid, slender in the upper parts, terete, smooth or almost so, yellowish green, minutely yellow-speckled, sparingly branched or simple, usually 5–10 dm. high, about 3 mm. in diameter at base; branches slender, simple or divided; sheaths closely convolute, elliptic-oblong, rounded or obtuse at the upper end of the persistent portion, aristate, coriaceous, nervose, buff-coloured, mostly

1·5–2·5 cm. long without the awn, with a pair of deciduous hyaline lobes at the upper margin; awn slender, acute, commonly 1·5 cm. long; male spikelets many, in panicled or spicate cymes, oblong, cuneate at base, many-flowered, 1·3–1·8 cm. long; spathe appressed to and about as long as the spikelet, lanceolate, acute, cartilaginous, nervose and straw-coloured in the lower half, the upper half hyaline and deciduous, leaving the midrib which appears as an awn; bracts loosely imbricate, oblong, spathe-like, about 1 cm. long, when in an advanced stage the membranous portion falls leaving the midrib as an awn; perianth often with its sides exposed, stipitate, oblong or cuneate, 4–5 mm. long; outer segments obtuse, cartilaginous, glabrous; the lateral oblong, navicular, unequal in length, with an entire or slightly lacerate, cartilaginous wing on the upper half of the midrib; the anterior segment linear-oblong; inner segments oblong-lanceolate, obtuse, membranous; female spikelets many, in panicled or spicate cymes, resembling the male, many-flowered, about 1·5 cm. long; spathe and bracts as in the male; perianth as in the male; male and female flowers may occur in the same spikelet; ovary obliquely ovate, 1-celled by abortion; styles 3, adjacent on the acute apex of the ovary, slender; seed smooth.

South Africa: Cape Province—Cape Div.: flats near Cape Point, *Schlechter*, 7302, ♂; Patrys Vley, *Wolley-Dod*, 2551, ♀; Schoester's Kraal, *Wolley-Dod*, 3293, ♀; marsh at head of Buffels River, *Pillans*, 4364, ⚥.

Var. β, purpureus (*Pillans*); spathes and bracts with their persistent parts drying purplish; perianth of the female flower often 6–7 mm. long; the outer lateral segments purplish on their upper parts.

Cape Province—Bredasdorp Div.: hills behind Rhenoster Kop, *Schlechter*, 10572, ♂, 10573, ♀.

The species is easily distinguishable by its pallid appearance from all others growing in its region.

39. R. sarcocladus, *Mast. in DC. Monog. Phan.*, i, 291 (1878)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895); *Mast. in Fl. Cap.*, vii, 93 (1897): **R. tabularis,** *Pillans in Ann. Bolus Herb.*, iii, 82, tab. v, fig. C (1921).

Stems arising sporadically from creeping rhizomes, erect, sparingly branched from below the middle and upwards, occasionally producing one or a few barren branches, usually accompanied by much-branched barren stems, rigid at base, slender upwards, terete, finely tubercled and wrinkled on their lower parts, almost smooth on their upper, yellow-speckled, 3–5 dm. high; sheaths closely clasping the stems, oblong, acute, subulate-mucronate, coriaceous, prominently nervose-striate, membranous at the margins, with two deciduous, membranous lobes at the apex, red-brown, yellow-speckled, mostly 1·5–2 cm. long; male spikelets solitary and terminal, rarely geminate, erect, at first lanceolate, becoming oblanceolate or oblong, many-flowered,

2–2·5 cm. long ; spathe like the uppermost sheath ; bracts loosely imbricate, oblong-lanceolate, acute, with a slender mucro, coriaceous, nervose, narrowly membranous at the margins, light brown, 1–1·3 cm. long ; perianth on a red stipe, linear-oblong, obtuse at apex, 3·5 mm. long ; outer segments cartilaginous, light brown ; the lateral navicular, linear-oblong, acute, slightly villous on the upper parts of the carina, unequal in size ; anterior segment lanceolate, obtuse, dorsally rounded, glabrous ; inner segments linear-oblong, obtuse, white-hyaline, about as long as the outer ; female spikelets like the male, many-flowered, solitary or rarely geminate, 2–2·5 cm. long ; spathes and bracts as in the male but the latter rather larger ; perianth on a short stipe, obliquely elliptic, obtuse at apex, 4 mm. long ; outer segments cartilaginous, externally scabrid, light brown ; one lateral segment navicular, linear-oblong, acute, villous-carinate, the other linear-oblong, acute, obtusely keeled and villous on its upper half or entirely glabrous, smaller than the first ; anterior segment linear-oblong, obtuse, dorsally rounded, glabrous ; inner segments oblong-lanceolate, obtuse, membranous, brownish, slightly shorter than the outer ; ovary narrowly ovate, 1-celled by abortion ; styles 3, adjacent, free, slender.

South Africa: Cape Province—Cape Div. : Table Mt., *Burchell*, 572, ♀, 605, ♀, *Pillans*, 3904, ♂ and ♀ ; east edge of Lower Plateau, Table Mt., *Pillans*, 4209, ♀ ; head of Echo Valley, Table Mt., *Pillans*, 4208, ♀.

40. R. dispar, *Mast. in Journ. Linn. Soc.*, viii, 246 (1865) ! ; *in DC. Monog. Phan.*, i, 274 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895) ; *Mast. in Fl. Cap.*, vii, 82 (1897) : **Hypolaena conspicua,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 15 (1900) ! : **Restio conspicuus,** *Pillans in Ann. Bolus Herb.*, iii, 85 (1921).

Stems arising sporadically from a creeping rootstock, erect, terete, almost smooth, white-speckled, rigid in the lower parts, slender in the upper, sparingly branched from about the middle and upwards, 6–10 dm. high, 2–3 mm. in diameter at the middle ; sheaths closely convolute, elliptic or ovate, acute or the lower sometimes obtuse, mucronate, coriaceous, at first broadly pale-membranous at the margins, nervose, mostly 1·5–2 cm. long ; male spikelets several or many, in spicate or panicled cymes, oblong or elliptic, usually 6–8-flowered, about 1 cm. long ; spathe erect, lanceolate, acute, subulate-mucronate, coriaceous, at first membranous at the upper margins, purple-brown, yellow-speckled, about equalling the spikelet in length ; bracts loosely imbricate, ovate-lanceolate, acute, mucronate, cartilaginous, purple and yellow-speckled on the apical parts, 8–10 mm. long ; perianth partly exposed, stipitate, oblong-elliptic, about 5 mm. long ; outer segments oblong, cartilaginous ; the lateral navicular, acute, villous on the upper half of the carina, unequal in length ; the anterior obtuse, glabrous ; inner segments shortly united at base, lanceolate, subacute, hyaline-

membranous; female spikelets several or many in a rather compact spicate cyme, for the most part hidden by the spathes, elliptic, 2- or 3-flowered, 1–1·4 cm. long; spathe embracing the spikelet, ovate-lanceolate, acuminate, subulate-mucronate, coriaceous, narrowly pale-membranous and lacerate at the margins, dorsally purple and yellow-speckled, distinctly broader and longer than the spikelet; bracts lanceolate, acute, carinate on the upper half of the dorsal side, cartilaginous, purple and yellow-speckled on the upper parts, 6–8 mm. long; perianth partly exposed beyond one side of its bract, stipitate, somewhat obliquely elliptic, about 5 mm. long; outer segments oblong-lanceolate, subacute, cartilaginous; the lateral navicular, villous on the upper half of the carina, unequal in length; the anterior glabrous or occasionally slightly villous on the upper parts of the midrib; inner segments ovate-lanceolate, acute, submembranous; ovary obliquely ovate, 1-celled by abortion; styles 3, thickened at base, 2 adjacent, 1 isolated.

South Africa: Cape Province—Cape Div.: along streams on hills west of Simon's Town, *Pillans*, 3571, ♂ and ♀.—Stellenbosch Div.: at the base of the Helderberg, *Bolus*, 5491, ♀.—Caledon Div.: mountains at Houwhoek, *Burchell*, 8068 partly, ♂, *Schlechter*, 7441, ♂; Genadendal, *Schlechter*, 10293, ♂, 10294, ♀.—Riversdale Div.: mountains near Riversdale, *Marloth*, 3646, ♂.

41. R. egregius, *Hochst. in Flora*, 1845, p. 337!; *Steud., Synops. Pl.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 245 (1865), incl. var.; *in DC. Monog. Phan.*, i, 288 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895); *Mast. in Fl. Cap.*, vii, 92 (1897).

Stems arising from creeping rootstocks, erect, terete, stout in the lower parts, becoming slender from about the middle upwards, almost smooth, grey-speckled, moderately branched in the upper half, 6–9 dm. high, about 3 mm. in diameter at the middle; sheaths closely convolute, ovate or elliptic, acute, stoutly mucronate, coriaceous, mostly 1·5–2·5 cm. long on the main stem, with the upper margins membranous and deciduous; male spikelets many, spreading or declinate, in panicled cymes, elliptic, becoming roundate, many-flowered, 1–1.5 cm. long; spathe bract-like but larger, about half as long as the spikelet, caducous; bracts erect-spreading, elliptic-oblong, obtuse, mucronate, coriaceous, smooth, shiny, purple-brown at apex, narrowly pale-membranous at the upper margins, 6–8 mm. long; perianth hidden, shortly stipitate, elliptic-oblong, about 4·5 mm. long; outer segments lanceolate, acute, cartilaginous, glabrous; the lateral navicular; inner segments lanceolate, acute, hyaline; female spikelets terminal and solitary on the branches, elliptic-oblong or broadly oblong, becoming obovate with fruiting, 3- or 4-flowered, mostly about 3 cm. long; spathe closely embracing the base of the spikelet bract-like but smaller, less than half as long as the spikelet; bracts closely imbricate, elliptic-ovate,

acute, subulate-mucronate, coriaceous, nervose, lacerate and membranous at the upper margins, about 2 cm. long; perianth hidden, on a stout stipe, ovate-lanceolate, 1–1·2 cm. long; segments acute, cartilaginous; the outer lanceolate, the lateral glabrous; the inner ovate-lanceolate; ovary rotundate, compressed, 2-celled; styles 3, adjacent at base, free; capsule 2-seeded; seeds rotundate, smooth, grey, with a prominent keel-like process at base.

South Africa: without precise locality, *Thom*, 632, ♂, 906, ♂, *Ludwig*, ♂, *Pickstone*, 4, ♂ and ♀.

Cape Province—Cape Div.: False Bay, *Robertson*, ♀; Klaas Jager's Berg, *Wolley-Dod*, 2394, ♂; Red Hill, *Rogers*, 11219, ♂; hills west of Simon's Town, *Pillans*, 4393, ♂ and ♀.—Stellenbosch Div.: Hottentots Holland Mts., *Ecklon*, ♂; Sir Lowry's Pass, *Schlechter*, 7239, ♂, 7240, ♀, *Rogers*, 11066, ♀.—Paarl Div.: mountains at French Hoek, *Pickstone*, 41, ♀.—Caledon Div.: Houwhoek, *Burchell*, 8071, ♂ and ♀; Zwartberg, *Ecklon and Zeyher*, ♂ and ♀, *Schlechter*, 9786, ♂, 9787, ♀; Steenbras, *Rogers*, 11062, ♂; Palmiet River Mts., *Guthrie in Bolus Herb.*, 16035, ♂; mountains between Villiersdorp and French Hoek, *Bolus*, 7491, ♀, 7492, ♂.

Restio macrogynus, Nees, MS. in herbaria belongs here.

42. R. compressus, *Rottb., Program.*, p. 11 (1772); *ejusd. Descr. et Icon.*, p. 6, tab. 2, fig. 4 (1773); *Willd., Sp. Pl.*, iv, pars 2, p. 725 (1806); *Spreng., Syst. Veg.*, i, 185 (1825), excl. syn.; *Steud. in Flora*, 1829, i, 133; *Nees in Linnaea*, v, 642 (1830); *ibid.*, vii, 616 (1832); *Kunth, Enum.*, iii, 403 (1841); *Drège, Zwei Pfl. Documente*, p. 117 (1844); *in Linnaea*, xx, 241 (1847); *Steud., Synops. Pl.*, ii, 253 (1855); *Mast. in Journ. Linn. Soc.*, viii, 249 (1865); in *DC. Monog. Phan.*, i, 290 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895); *Mast. in Fl. Cap.*, vii, 95 (1897): **R. praeflexus,** *Mast. in Bull. Herb. Boiss.*, ser. 2, i, p. 778 (1901) !.

Stems arising sporadically from creeping rhizomes, erect, rigid, and terete in their lower parts up to about the middle, slender and gradually compressed upwards, moderately or much branched in the upper half or simple, rugulose or wrinkled, usually 6–9 dm. high; branches slender, much compressed; sheaths closely convolute, elliptic-lanceolate, acute, coriaceous, externally smooth or nervose, mostly 1·5–2·5 cm. long, with the median nerve excurrent in a subulate mucro, often including a woolly scale; male spikelets many in a lax, spicate cyme, at first oblanceolate, becoming cuneate, slightly compressed, many-flowered, 1–1·5 cm. long; spathes caducous, ovate-lanceolate, acute, mucronate, coriaceous, narrowly membranous at the upper margins, shorter than the spikelet; bracts erect-spreading, oblong-lanceolate, acute, mucronate, coriaceous, 8–12 mm. long; perianth stipitate, oblong-elliptic, 3 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral villous-carinate; the anterior

dorsally rounded, glabrous; inner segments lanceolate, acute, flattened, membranous; female spikelets solitary or geminate in a spicate cyme, oblong or elliptic, many-flowered, about 2 cm. long; spathe subpersistent, clasping the base of the spikelet, ovate, acute, mucronate, coriaceous, smooth, red-brown, less than half the length of the spikelet; bracts loosely imbricate or erect-spreading, oblong-lanceolate, mucronulate, coriaceous, smooth, red-brown, about 1 cm. long; perianth stipitate, elliptic, becoming orbicular with fruiting, 3–3·5 mm. long; outer segments cartilaginous; the lateral oblong-lanceolate, acute, navicular, villous on the upper half of the keel; the anterior elliptic, obtuse, glabrous; inner segments ovate, acute, flattened, cartilaginous, membranous at the margins; ovary rotundate, compressed, with an anterior vertical ridge, 2-celled; styles 3, adjacent at base, free.

South Africa: Cape Province—Cape Div.: Kirstenbosch, *Page in Bolus Herb.*, 16037, ♂ and ♀; banks of streams, west slopes of the Muizenberg, *Pillans*, 3791, ♀; along the Silver Mine Stream, *Pillans*, 4391, ♂.—Stellenbosch Div.: Stellenbosch, *Ecklon and Zeyher*, ♂.—Malmesbury Div.: Groene Kloof, *Drège*, 34 partly, ♂.—Swellendam Div.: mountain near Swellendam, *Burchell*, 7388, ♂ and ♀; between Spaarbosch and Tradouw, *Drège*, 33, ♂ and ♀; mountain at Zuurbraak, *Galpin*, 4791, ♂.—Riversdale Div.: Langebergen, *Schlechter*, 1914, ♀; Phisantefontein, *Muir*, 3204, ♂.—George Div.: on the Post Berg, near George, *Burchell*, 5900, ♂; Cradock Berg, *Galpin*, 4790, ♂.—Humansdorp Div.: Witte Els Bosch, *Fourcade*, 1417, ♂ and ♀.

43. R. major, *Pillans*, sp. nov.: **R. compressus,** var. **major,** *Mast. in Journ. Linn. Soc.*, viii, 249 (1865)!; *in DC. Monog. Phan.*, i, 291 (1878); *in Fl. Cap.*, vii, 95 (1897); *Marloth, Flora S. Afr.*, iv, 62, tab. 15, B, fig. 14A, (1915).

Stems erect, rather stout and terete in their lower parts, from about the middle upwards becoming slenderer and compressed, smooth or rugulose, moderately branched in the upper half, usually 6–9 dm. high; sheaths closely convolute, oblong-lanceolate, acute, coriaceous, often nervose on the exterior surface, mostly 3–5 cm. long, with the midrib excurrent in a stout, subulate mucro, frequently 1 cm. long; male spikelets many in a spicate cyme, erect-spreading, cuneate, many-flowered, about 2 cm. long; spathes sheath-like, caducous; bracts loosely imbricate or erect-spreading, lanceolate, acute, cartilaginous, smooth, the lower 10–15 mm. long, the upper 5–8 mm. long; perianth stipitate, elliptic, about 4 mm. long; outer segments linear-oblong, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior glabrous; the inner oblong-lanceolate, subacute, membranous; female spikelets usually 2–4 in a spicate cyme, oblong or oblanceolate, many-flowered, 3–4 cm. long; spathes persistent, sheath-

like, ½–¾ as long as the spikelet; bracts loosely imbricate, oblong-lanceolate, acuminate, cartilaginous, smooth red-brown, about 2 cm. long; perianth on a rather stout, papillate stipe, elliptic, becoming orbicular with fruiting, 4–4·5 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral villous-carinate; the anterior glabrous; inner segments ovate, acute, cartilaginous; ovary orbicular, compressed, 2-celled; styles 3, adjacent at base, free, slender; capsule 2-seeded; seeds rotundate, with wavy ridges, grey.

South Africa: without precise locality, *Holub*, ♂, *Sieber*, 224, ♂ and ♀.

Cape Province—Cape Div.: Table Mt., *Burchell*, 568, ♀, *Ecklon*, 92, ♂ and ♀, *Bolus*, 4437, ♀, 4730, ♂, *Marloth*, 3127, ♀, 3135, ♂, *Wolley-Dod*, 2610, ♀, 3247, ♀, *Fries*, ♂ and ♀, *Pillans*, 3134, ♂ and ♀; Cape Flats, *Buchanan*, 161, ♂; False Bay, *Robertson*, ♀.—Caledon Div.: Babylons Tower, *Zeyher*, 4350, ♂; near Knoblauch, *Ecklon*, 84, ♂.

The fertile stems are usually accompanied by much-divided, very compressed, sterile stems, having leaf-sheaths with a foliaceous mucro. The whole plant is more compact and much stouter than in its near ally *R. compressus*, Rottb.

44. R. purpurascens, *Nees ex Mast. in Journ. Linn. Soc.*, viii, 249 (1865)!; *in DC. Monog. Phan.*, i, 283 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895); *Mast. in Fl. Cap.*, vii, 88 (1897).

Stems erect, terete in the lower parts, more or less compressed or less often terete in their upper parts, very closely studded with flat-topped, grey tubercles, stout and rigid at base, moderately branched, rarely simple, 6–12 dm. high, 4–5 mm. in diameter at base; branchlets slender, usually virgate; sheaths closely convolute, elliptic, oblong-elliptic or rotundate on lower parts of the stem, rounded or obtuse at apex, coriaceous, mostly 2·5–3 cm. long on the middle parts of the stems, closely studded with flat-topped tubercles, broadly pale-membranous at the upper deciduous margin, with a dorsally compressed, stout mucro about 1 cm. long; male spikelets several or many, in flexuose, spicate or subpanicled cymes, broadly cuneate, many-flowered, 2–2·5 cm. long; spathe appressed to the spikelet, lanceolate, acute, aristate, coriaceous, cartilaginous at the side margins, dorsally rugulose, purplish, yellow-speckled, equalling or slightly exceeding the spikelet, with a deciduous, broadly pale-membranous upper margin; bracts erect-spreading, oblong-lanceolate, subacute, chartaceous, membranous at the upper margins, 1–1·5 cm. long; perianth for the most part exposed, stipitate, elliptic, 3·5–4 mm. long; outer segments oblong-lanceolate, cartilaginous; the lateral navicular, acute, villous-carinate; the anterior obtuse, glabrous; inner segments lanceolate, obtuse, hyaline-membranous, connate at base; female spikelets several or many, in spicate or subpanicled cymes, cuneate-oblong, many-flowered, 2–3 cm. long; spathe appressed to the spikelet,

oblong-lanceolate, acute, aristate, cartilaginous, dorsally nervose and rugulose, purple-brown, distinctly longer than the spikelet or rarely shorter, with a deciduous, broadly membranous upper margin; bracts loosely imbricate, oblong-lanceolate, subacute, occasionally mucronulate, chartaceous, nervose, purple, paler at the margins, sparsely yellow-speckled, 1·5–2 cm. long; perianth hidden except from above, on an oblong stipe, elliptic, about 5 mm. long; segments lanceolate, cartilaginous; the outer lateral navicular, acute, villous-carinate; the anterior obtuse, glabrous or slightly villous on the midrib; inner segments subacute or obtuse; ovary rotundate, compressed, 2-celled; styles 3, connate and nude at base; capsule 2-seeded.

South Africa : without precise locality, *Lind in Brit. Mus. Herb.*, ♂.

Cape Province—Caledon Div.: Hottentots Holland Mts., *Zeyher in South African Mus. Herb.*, 12937, ♀; between Palmiet River and Kleinmond, *Stokoe*, 1330, ♂ and ♀.

45. R. bifarius, *Mast. in Journ. Linn. Soc.*, x, 278 (1868)!; *in DC. Monog. Phan.*, i, 288 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895); *Mast. in Fl. Cap.*, vii, 91 (1897).

Stems erect, simple or sparingly branched, terete, almost smooth or rugulose, minutely grey-speckled, rigid in the lower parts, slender in the upper, 5–10 dm. high, 2–2·75 mm. in diameter at the middle; sheaths closely convolute, elliptic-oblong or oblong, acute, subulate-mucronate, coriaceous, membranous at the upper margins, dorsally nervose-striate, purple-brown, yellow-speckled, mostly 2–3 cm. long; male spikelets many, in panicled cymes, erect or, because of the much compressed, slender rhachis, occasionally declinate in the upper portion of the inflorescence, oblong, many-flowered, 2–2·5 cm. long; spathe bract-like but mucronate and yellow-speckled, scarcely reaching to the middle of the spikelet; bracts loosely imbricate, shortly spreading at the apex, lanceolate, acute, mucronulate, cartilaginous, narrowly membranous at the margins, minutely scabridous on the outer surface, dark purple, about 1·5 cm. long; perianth hidden, stipitate, elliptic-oblong, 4 mm. long; outer segments oblong, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior glabrous; inner segments lanceolate-oblong, obtuse, membranous; female spikelets 1–3 in a spicate cyme, oblong or ovate-oblong, many-flowered, 2·5–3·5 cm. long; spathe sheath-like, ovate, mucronate, scarcely reaching the middle of the spikelet; bracts loosely imbricate or erect-spreading in their upper parts, ovate- or oblong-lanceolate, mucronulate, cartilaginous, narrowly membranous and somewhat undulate at the margins, nervose, dark purple, 1·5–2 cm. long; perianth hidden, on a villous stipe, elliptic, purplish, 4·5–6 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, subequal in length; the lateral navicular, villous-carinate; the

anterior glabrous; inner segments lanceolate, obtuse, submembranous; ovary rotundate, compressed, 2-celled; styles 3, adjacent at base; capsule 2- or, by abortion, 1-seeded; seeds broadly oblong, quadrangular, grey, with vertical rows of minute pits.

South Africa: Cape Province—Stellenbosch Div.: summit of mountains near Stellenbosch, *Marloth*, 3637, ♀.—Caledon Div.: Houw Hoek Mts., *Burchell*, 8068 partly, ♂ and ♀.

The male and female spikelets of this species bear a striking resemblance to those of *Staberoha*.

46. R. callistachyus, *Kunth, Enum.*, iii, 400 (1841)!; *Drège, Zwei Pfl. Documente*, 126 (1844); *Steud., Synops. Pl.*, ii, 253 (1855); *Mast. in Fl. Cap.*, vii, 94 (1897): **R. polystachyus,** *Kunth, op. cit.*, 402!; *Steud., loc. cit.*: **R. spinulosus,** *Kunth, loc. cit.*!; *Drège, op. cit.*, 122; *Steud., loc. cit.*; *Mast. in Journ. Linn. Soc.*, viii, 249 (1865); *in DC. Monog. Phan.*, i, 292 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 94: **R. concolor,** *Steud., op. cit.*, 251!; *Mast. in Journ. Linn. Soc.*, viii, 228, 254; *in DC. Monog. Phan.*, i, 241; *Durand et Schinz, op. cit.*, 505: **R. fastigiatus** [*Nees ex Drège in Linnaea*, xx, 241 (1847), nomen]; *Nees ex Mast. in Journ. Linn. Soc.*, viii, 250!, non *R. Br.*: **R. Mastersii,** *F. Muell., Fragment. Phyt. Austr.*, viii, 68 (1872–74)!; *Mast. in DC. Monog. Phan.*, i, 292; *Durand et Schinz, op. cit.*, 508.

Stems erect, terete, stout, much divided in their upper parts into slender, somewhat compressed branches, smooth, rugulose or faintly striate, usually 1–2 m. high; sheaths tightly convolute, ovate or lanceolate-ovate, acute, subulate-mucronate, coriaceous, dorsally nervose, on the main stems mostly 3–4 cm. long; on the slender branches about 1 cm. long; male spikelets usually 4–9 in a lax spicate cyme, separated by about their own length in the middle part of the inflorescence, oblong or ovate, many-flowered, 6–9 mm. long; spathes deciduous, ovate-lanceolate, acute, subulate-mucronate, coriaceous, cartilaginous at the margins, nervose, purple-spotted, equalling or slightly longer than the spikelet; bracts erect-spreading, oblong-ovate, acute, mucronate, cartilaginous, smooth, 4–5 mm. long; perianth stipitate, partly exposed, elliptic-oblong, 2–3 mm. long; segments oblong, acute, membranous; the outer lateral villous-carinate; the anterior dorsally rounded, glabrous; inner segments flattened, hyaline; female spikelets 1–3 in a spicate cyme, oblong or obovate, many-flowered, 1–2 cm. long; spathe sheath-like, closely embracing the base of the spikelet, reaching to about the middle of the spikelet; bracts erect-spreading, oblong-lanceolate, subulate-mucronate, flattened, usually somewhat undulate at the margins, cartilaginous, nervose, 8–14 mm. long; perianth almost entirely hidden, stipitate, elliptic, 2–3 mm. long; outer segments obovate, acute, cartilaginous, hyaline at the margins; the lateral villous-carinate; the anterior

glabrous; inner segments broadly obovate, subacute; ovary rotundate, compressed, 2-celled; styles 3, united at base and forming a short stylopodium, densely villous from the base upwards; capsule 2-seeded; seeds ovate, tubercled, reddish.

South Africa: without precise locality, *Verreaux*, ♂, *Drège*, 31, ♂, 32, ♂.

Cape Province—Stellenbosch Div.: Sir Lowry's Pass, *O. Kuntze*, ♀.—Caledon Div.: Hottentots Holland Mts., *Zeyher*, ♂ and ♀; Steenbras River, *MacOwan in Herb. Austr.-Afr.*, 1669, ♂ and ♀; Villiersdorp, *Schlechter*, 9903, ♀.—Tulbagh Div.: Artois, *Bolus*, 7466, ♀.—Ceres Div.: Mitchell's Pass, *Bolus*, 9663, ♀, *Schlechter*, 9968, ♂.—Riversdale Div.: Glen Leith, south slopes of Lange Berg, *Muir*, 3301, ♂ and ♀.—George Div.: without precise locality, *Burchell*, 5812, ♂ and ♀.—Knysna Div.: in bed of Krantz Bosch River, *Keet*, 974, ♂ and ♀.—Uniondale Div.: between Welgelegen and Onzer, *Drège*, 37 partly, ♂; Wagenbooms River, *Fourcade*, 2526, ♂ and ♀.—Humansdorp Div.: near Wagenboom Station, north side of Kromme River, *Burchell*, 4843, ♀; Kromme River, *Drège*, 30, ♀; Storms River, *Schlechter*, 5982, ♀; Humansdorp, *Rogers*, 2815, ♀, 4674, ♀.—Uitenhage Div.: Zwartkops River, *Ecklon*, 539, ♀.—Port Elizabeth Div.: Springfields, *Paterson*, 2198, ♀, 2476, ♀; Van Staadens, *Paterson*, 2517, ♂, 2518, ♂ and ♀.

In the above quoted specimens the female spikelets show much variation in size, but the floral characters do not differ sufficiently to justify separation of the two extremes.

47. R. bifidus, *Thunb. in Hoffm. Phytog. Blätter.*, i, 7 (1803)!; *in Weber et Mohr Archiv.*, i, 25 (1804); *Thunb., Fl. Cap.*, ed. *Schultes*, 87 (1823); *Nees in Linnaea*, v, 636 (1830), excl. var. β et syn. *R. filiformis, Poir.*; *Drège, Zwei Pfl. Documente*, 88 (1844); *Mast. in Journ. Linn. Soc.*, xiv, 415 (1875), non *R. vaginatus, Thunb.*; *in DC. Monog. Phan.*, i, 284 (1878); *in Journ. Linn. Soc.*, xxi, 590, Nos. 5 et 20 (1885), non *R. vaginatus, Thunb.*; *in Fl. Cap.*, vii, 89 (1897): **R. pseudo-leptocarpus,** *Kunth, Enum.*, iii, 399 (1841)!; *Drège, op. cit.*, 89; *Steud., Synops.*, ii, 252 (1855): **Schoenus capensis,** *Linn. Herb. ex Mast. in Journ. Linn. Soc.*, xxi, 590, No. 4 (1885)!.

Stems caespitose, erect, filiform, terete, rugose or obscurely tubercled, simple or sparingly branched, 2–5 dm. high, scarcely 1 mm. in diameter at base; sheaths closely convolute, elliptic-oblong, acute, mucronate, coriaceous, with the upper margin produced into two deciduous, membranous lobes, usually 1–1·5 cm. long; male spikelets 1–3, in spicate cymes, oblong or elliptic, many-flowered, 1–1·6 cm. long; spathes like the upper sheaths but more open, scarcely half as long as the spikelet; bracts erect-spreading, oblong- or ovate-lanceolate, acute, mucronate, almost flattened, often with the margins slightly recurved, coriaceous, thinner at the margins, nervose,

with the mucro and upper margins purple-brown, 6–8 mm. long; perianth shortly stipitate, elliptic-oblong, 4 mm. long; outer segments oblong, acute, cartilaginous; the lateral navicular, villous-carinate; the anterior glabrous; inner segments lanceolate, acute, hyaline, rather flattened; female spikelets solitary or in pairs, oblong or elliptic, many-flowered, 1–1·5 cm. long; spathe and bracts as in the male; perianth stipitate, broadly elliptic, about 2·5 mm. long; outer lateral segments ovate-lanceolate, acute, navicular, villous-carinate, cartilaginous; the anterior oblong-oblanceolate, glabrous; inner segments ovate, acute, membranous, distinctly shorter than the outer; ovary rotundate, compressed, 2-celled; styles 3, free; capsule 2-seeded.

South Africa: without precise locality, *Sparrman*, ♂, *Masson*, ♂, *Ludwig*, ♀, *Sieber*, 221, ♂ and ♀.

Cape Province—Cape Div.: Table Mt., *Burchell*, 541, ♂, 573, ♂, *Drège*, 28, ♂ and ♀, *Zeyher*, ♂, *Pappe*, ♂, *Bolus*, 4439, ♀, 4440, ♂, *Marloth*, 3216, ♂ and ♀, *Fries*, *Garside*, 1490, ♂, *Pillans*, 3133, ♂ and ♀, 4385, ♂ and ♀.—Caledon Div.: Houwhoek, *Burchell*, 8070, ♀, *Schlechter*, 7570, ♂ and ♀, 7571, ♀.

48. R. exilis, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 6 (1900) !.

Stems caespitose, erect, simple or very sparingly branched, filiform, terete, slightly rough with obscure tubercles, about 4 dm. high; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, nervose, broadly membranous at the upper margins, mostly 1–1·5 cm. long; male spikelets usually 1–4 in a lax spicate cyme, oblong, many-flowered, 1·5–2 cm. long; spathe ovate- or oblong-lanceolate, acute, stoutly mucronate, coriaceous, with the mucro reaching to about the middle of the spikelet; bracts loosely imbricate, elliptic-lanceolate, acute, mucronate, cartilaginous, nervose, iridescent, purple-brown on the upper margins, 8–9 mm. long; perianth hidden, oblanceolate, 4–5 mm. long; outer segments oblanceolate-oblong, acute, cartilaginous, purplish at apex; the lateral villous-carinate on the upper half; inner segments elliptic-oblong, obtuse, flattened, hyaline, distinctly shorter than the outer; female spikelets fewer than those of the male which they resemble; spathe and bracts as in the male but the latter slightly larger; perianth stipitate, compressed, oblong-elliptic, 4 mm. long; outer segments lanceolate, acute, cartilaginous, purple at apex; the lateral navicular, villous-carinate; the inner segments ovate-lanceolate, obtuse, for the most part membranous; ovary rotundate, 2-celled; styles 3, adjacent at base; capsule orbicular, 2-seeded.

South Africa: Cape Province—Caledon Div.: mountains at Genadendal, *Schlechter*, 10290, ♂, 10291, ♀.

49. R. micans, *Nees in Linnaea*, v, 649 (1830) !; *Mast. in Fl. Cap.*, vii, 98 (1897): **Thamnochortus micans,** *Kunth, Enum.*, iii, 441 (1841) !: **Restio bigeminus**, *Nees ex Mast. in Journ Linn. Soc.*, viii, 246 (1865) !; *in DC.*

Monog. Phan., i, 289 (1878); *in Journ. Linn. Soc.*, xxi, 576 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895); *Mast. in Fl. Cap.*, vii, 91.

Stems caespitose, erect, slender, terete, nearly smooth, grey-speckled, 3–5 dm. high, scarcely 2 mm. in diameter at base; branches usually compressed in their lower parts; sheaths closely convolute, oblong, obtuse, coriaceous, nervose, broadly membranous at the upper margins, mostly 1·2–1·5 cm. long, with a compressed, obtuse mucro; male spikelets many, in panicled cymes, declinate, oblong, acuminate at base, 4- or 5-flowered, about 1·2 cm. long; spathe closely embracing the base of the spikelet, elliptic-oblong, obtuse, mucronate, coriaceous, broadly membranous at the upper margins, less than half as long as the spikelet; bracts closely imbricate, ovate-lanceolate, acute or the lower obtuse, mucronulate, cartilaginous, nervose, iridescent, purple at the margins, 5–6 mm. long; perianth stipitate, oblong, 3·5–4 mm. long; segments linear-lanceolate, acute, glabrous; the outer lateral navicular; female spikelets several, in spicate or panicled cymes, erect, oblong, tapered at base, many-flowered, about 2 cm. long; spathe as in the male; bracts imbricate, lanceolate, acute, mucronulate, cartilaginous, nervose, iridescent, purple at the margins and between the upper parts of the nerves, mostly 1·3–1·5 cm. long; perianth on a rather long stipe, ovate-lanceolate, 4–5 mm. long; outer segments ovate-lanceolate, acute, cartilaginous, pale, purplish at apex, glabrous; inner segments ovate-lanceolate, acute, membranous; ovary rotundate, compressed, 2-celled; styles 3, adjacent at base, free, short, with long woolly hairs on the inner surface; capsule 2-seeded.

South Africa: Cape Province—Cape Div.: Cape Flats, *Rehmann*, 1803, ♂; flats near Wynberg, *Zeyher*, 1123, ♀, *Bolus*, 4448, ♀, 4454, ♀; sandy flats 2 miles east of Newlands, *Pillans*, 3814, ♂, 3815, ♀.

50. R. pedicellatus, *Mast. in Journ. Linn. Soc.*, viii, 252 (1865)!; *in DC. Monog. Phan.*, i, 286 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895); *Mast. in Fl. Cap.*, vii, 90 (1897).

Stems caespitose, erect, very slender, simple, terete, 2·5–4 dm. high, with minute, slightly raised, golden speckles; sheaths closely convolute, oblong-lanceolate, acute or acuminate, subulate-mucronate, nervose, coriaceous, membranous at the upper margin, 1–1·5 cm. long; male spikelets, 1–3 in a spicate cyme, oblong or elliptic, many-flowered, about 1 cm. long; spathe sheath-like, closely embracing the base of the spikelet, ovate or ovate-lanceolate, scarcely reaching the middle of the spikelet; bracts loosely imbricate, broadly ovate, acute, mucronulate, cartilaginous, smooth, chestnut-brown, 4–5 mm. long; perianth subsessile, elliptic-oblong, about 4 mm. long; outer segments cartilaginous, glabrous; the lateral navicular, oblong-lanceolate, obtuse, often divergent at apex; the anterior lanceolate, acute; inner segments ovate-lanceolate, obtuse, flattened, with involute

margins, hyaline-membranous; female spikelets like the male, 1–3 in a spicate cyme, about 5-flowered, 8–12 mm. long; spathe as in the male; bracts loosely imbricate, oblong- or ovate-lanceolate, acute, mucronulate, 5–6 mm. long; perianth hidden by its bract, on a villous stipe, oblong or elliptic-oblong, trigonous, 3·5–4 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, dorsally scabridous; the lateral navicular, glabrous or minutely villous on the carinal angle; the anterior dorsally rounded; inner segments ovate-lanceolate, subacute, hyaline-membranous, flattened, with involute margins, more or less united at the base; the lateral joined by the base of the midrib to the outer segments; ovary elliptic, 3-celled; styles 3, united at base; capsule 3- or, by abortion, 2-celled; seeds studded with grey tubercles.

South Africa: without precise locality, *MacOwan in Herb. Mus. Austr.-Afr.*, 12860, ♂, 12865, ♀.

Cape Province—Caledon Div.: Houwhoek, *Schlechter*, 7496, ♀.—Ceres Div.: at the base of mountains at Ceres, *Bolus*, 5483, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 82 partly, ♂, 91, ♀, 1629 partly, ♂ and ♀, 1631*b*.

51. R. tuberculatus, *Pillans in Ann. Bolus Herb.*, iii, 146 (1922): **Leptocarpus divaricatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 9 (1900) !.

Stems erect, rigid in their lower parts, slender in their upper, terete, coarsely tubercled, moderately branched, apparently about 5 dm. high; sheaths loosely convolute, elliptic, obtuse or acute, mucronate, coriaceous, dorsally rugose, broadly pale-membranous at the margins, about 1·5 cm. long on the main stem; male spikelets several or many in spicate or subpanicled cymes, elliptic or rotundate, many-flowered, 5–8 mm. long; spathe sheath-like, very broadly membranous at the upper margins, about half as long as the spikelet; bracts loosely imbricate, ovate-rotundate, acute, mucronate, cartilaginous, finely lacerate-ciliate at the margins, 2·5–3 mm. long; perianth partly exposed beyond its bract, oblong-elliptic or cuneate-elliptic, 2·5 mm. long; outer segments oblong-lanceolate, submembranous, buff; the lateral navicular, acute, sparsely villous on the carina; the anterior subacute, glabrous; inner segments lanceolate, acute, hyaline-membranous; female spikelets resembling the male, but fewer, several-flowered; spathe and bracts as in the male, the latter forced outwards by the flowers; perianth partly exposed beyond its bract, stipitate, elliptic, 3 mm. long; outer segments oblong-lanceolate, cartilaginous; the lateral navicular, acute, glabrous or slightly villous on the upper half of the keel; the anterior subacute; inner segments lanceolate, subacute, submembranous; ovary rotundate, compressed, 2-celled; styles 3, adjacent, free.

South Africa: Cape Province—Clanwilliam Div.: Olifants River

Mts., *Schlechter*, 5117, ♀; Koudeberg, near Wupperthal, *Schlechter*, 8776, ♂, 8777, ♀.

52. R. scaber, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 1 (1900) !.

Stems caespitose, erect, terete, slender, studded with prominent, pale tubercles, sparingly branched, 3–4 dm. high, scarcely 1 mm. in diameter at base; sheaths closely convolute, oblong, rounded at the apex, with a somewhat flattened and obtusely pointed awn, coriaceous, tubercled, with the upper margin produced into two deciduous, hyaline lobes, usually 1–1·5 cm. long; male spikelets 1 or 2 in spicate cymes, oblong or obovate, cuneate at base, many-flowered, about 1 cm. long; spathe sheath-like, about equal with the spikelet; bracts imbricate, eventually erect-spreading, ovate, acute, subulate-mucronate, coriaceous, at the upper margins produced into two deciduous, hyaline-membranous lobes, purple-spotted on the upper half, about 7 mm. long; perianth shortly stipitate, elliptic-oblong, 3–5 mm. long; outer segments subacute, cartilaginous, equal; the lateral elliptic-oblong, carinate, villous on the upper half of the keel; the anterior oblong, glabrous; inner segments shortly united at base, oblong-lanceolate, acute, membranous, distinctly shorter than the outer; female spikelets solitary or in pairs, resembling the male, 2- or 3-flowered; spathe and bracts as in the male or the latter slightly larger; perianth shortly stipitate, elliptic-oblong, 4 mm. long; outer segments oblong-lanceolate, acute, cartilaginous, equal; the lateral villous-carinate; the anterior glabrous; inner segments shortly united at base, lanceolate, acute, membranous, distinctly shorter than the outer; ovary elliptic, surmounted by a stylopodium, 2-celled; styles 3, widely separated, filiform; capsule 2-seeded.

South Africa: Cape Province—Caledon Div.: Zwartberg, *Schlechter*, 10366, ♂ and ♀.

53. R. communis, *Pillans*, sp. nov.; culmis gracilibus teretibus tuberculatis ramosis; vaginis arcte convolutis elliptico-oblongis aristatis, apice late obtusis vel emarginatis, ad margines superiores membranaceo-lobatis; spiculis masculis spicatim cymosis late cuneatis; bracteis erecto-patentibus oblongo-lanceolatis acutis; perianthio aperto stipitato oblongo-cuneato; segmentis exterioribus oblongo-lanceolatis, lateralibus villoso-carinatis; segmentis interioribus oblongis membranaceis; spiculis femineis spicatim cymosis cuneatis 2–4-floris; bracteis erectis ut in mare; perianthio valde aperto stipitato elliptico-cuneato; segmentis lanceolatis acutis, exterioribus lateralibus villoso-carinatis; ovario rotundato biloculari; stylis tribus.

Stems in loose tufts, erect, slender, terete, tubercled (often coarsely), 3–7 dm. high, with many or several slender or filiform branches arising from below the middle and upwards, occasionally simple; sheaths closely convolute, elliptic-oblong, rounded or emarginate at the upper margin, with a blunt awn, cartilaginous, externally tubercled, mostly 1–2 cm. long,

with 2 deciduous, hyaline-membranous lobes at the upper margin; male spikelets 2–4 in a lax, spicate cyme, broadly cuneate, laxly few- or many-flowered, 1–2 cm. long; spathe sheath-like, embracing one side of the spikelet, purplish, yellow-speckled, usually exceeding the spikelet; bracts erect-spreading, oblong-lanceolate, acute, somewhat flattened, chartaceous, about 8 mm. long; perianth entirely exposed or almost so, on a slender, red stipe, oblong-cuneate, obtusely 3-angled, 3–4 mm. long; outer segments oblong-lanceolate, cartilaginous; the lateral navicular, acute, villous-carinate on the upper half; the anterior obtuse, glabrous; inner segments oblong, obtuse, membranous; female spikelets 2–4 in a spicate cyme, resembling the male but narrower, 2–4-flowered, usually 8–12 mm. long; spathe as in the male but with the awn often much overtopping the spikelet; bracts erect, oblong-lanceolate, acute, with a prominent median nerve, chartaceous, about 5 mm. long; perianth mostly exposed, elliptic-cuneate, becoming rotundate with the development of fruit, obtusely 3-angled, 3·5-4 mm. long; segments lanceolate, acute, cartilaginous; the outer lateral navicular, villous-carinate in the upper half; the anterior occasionally villous on the upper parts of its midrib; ovary rotundate, compressed, 2-celled; styles 3, separated at base, free; capsule 2-seeded; seeds smooth.

South Africa: Cape Province—Cape Div.: growing densely massed on marshy slopes in middle part of Silver Mine Valley, mountains west of the Muizenberg, *Pillans*, 4135, ♂ and ♀, 4183, ♂ and ♀.

54. R. leptostachyus, *Kunth, Enum.*, iii, 407 (1841)!; *Drège, Zwei Pfl. Documente*, 84 (1844); *Steud., Synops.*, ii, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 237 (1865); *in DC. Monog. Phan.*, i, 262 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895); *Mast. in Fl. Cap.*, vii, 78 (1897).

Stems erect or occasionally decumbent at base, filiform, terete, wrinkled, minutely tubercled, 3–5 dm. high, producing many branches which form a tangled mass of growth; sheaths closely convolute, oblong, obtuse or subacute, subulate-mucronate, coriaceous, membranous at the margins, with 2 membranous lobes arising from the upper margin, mostly 7–10 mm. long; male spikelets 1–5, laxly spicate-cymose, cuneate, somewhat compressed, several- or many-flowered, 5–8 mm. long; spathe sheath-like, lanceolate, 5–8 mm. long; bracts widely separated on the rhachilla, erect-spreading, lanceolate, acute, chartaceous, membranous at the upper margins, pale buff, 4·5–6 mm. long; perianth on a short, reddish stipe, cuneate, 2–2·5 mm. long; segments linear-lanceolate, acute; the outer cartilaginous, glabrous; the inner hyaline, shorter; female spikelets solitary, resembling the male, 1–3-flowered, 5–8 mm. long; spathe and bracts as in the male; perianth on a red stipe, cuneate or oblong-cuneate, about 3·5 mm. long; segments cartilaginous, otherwise as in the male; ovary elliptic, 2-celled; styles 3, free; capsule oblique, 1-seeded by abortion.

South Africa : without precise locality, *Rehmann*, 655, ♂.

Cape Province—Paarl Div.: French Hoek Mountains, *Drège*, 12, ♂ and ♀.

55. R. pusillus, *Pillans*, sp. nov.; culmis erectis vel basi decumbentibus filiformibus teretibus rugulosis albido-maculosis ramosissimus; vaginis arcte convolutis oblongis obtusis aristatis coriaceis nervosis marginibus superioribus late hyalino-membranaceis; spiculis masculis solitariis cuneatis laxe 2- vel 3-floris; spathis vaginiformibus; bracteis erecto-patentibus decurrentibus oblongo-lanceolatis acutis aristatis cartilagineis nervosis marginibus pallido-membranaceis; perianthio breviter stipitato cuneato trigono; segmentis exterioribus lineari-oblongis acutis cartilagineis glabris; segmentis interioribus lineari-oblongis obtusis membranaceis pallidis externis subaequalibus; spiculis femineis solitariis cuneatis 1-floris; spathis vaginiformibus; bracteis anguste oblongo-lanceolatis acuminatis cartilagineis nervosis marginibus pallido-membranaceis; perianthio stipitato oblongo vel cuneato trigono apice oblique truncato; segmentis exterioribus oblongo-lanceolatis acutis cartilagineis glabrescentibus; segmentis interioribus lineari-lanceolatis obtusis membranaceis apice saepe emarginatis externis subaequalibus; ovario sessili ovato-oblongo abortione 1-loculari; stylis tribus gracilibus brevibus; fructu obovato.

Stems loosely tufted, erect, often decumbent at base, terete, filiform, rugulose, white-speckled, much branched from near the base and upwards, 2–7 dm. high; sheaths closely convolute, oblong, rounded at apex, with a straight, compressed, blunt awn, coriaceous, with 3–5 prominent nerves, reddish, pale-membranous at the margins and apex, 6–10 mm. long with the awn; male spikelets solitary, terminal, cuneate, lax, 2- or 3-flowered, about 1 cm. long; spathe sheath-like, erect, about half as long as the spikelet; bracts widely separated on a bent rhachilla, long-decurrent at base, all except the uppermost fertile, oblong-lanceolate, acute, slender-aristate, cartilaginous, light brown, paler and membranous at the margins and apex, the fertile 6–8 mm. long; perianth on a short red stipe, cuneate, trigonous, 2·5–3 mm. long; outer segments linear-oblong, acute, dorsally rounded, cartilaginous, glabrous, reddish brown, one being somewhat galeate at its apex; inner segments linear-oblong, obtuse, flattened, membranous, pale, nearly equalling the outer; female spikelets solitary, terminal, cuneate, with one perfect and one rudimentary flower, 6–8 mm. long; spathe sheath-like, erect, nearly as long as the spikelet; fertile bract erect, loosely embracing the perianth, narrowly oblong-lanceolate, acuminate, cartilaginous, nervose, pale red, pale-membranous at the margins and apex, 4·5–5·5 mm. long; perianth on a stout, papillate stipe, oblong or cuneate, obliquely truncate at apex, trigonous, 2–2·75 mm. long; outer segments oblong-lanceolate, acute, dorsally rounded, cartilaginous; the lateral

minutely hispid on the upper half of the midrib, one being somewhat galeate at its apex; inner segments linear-lanceolate, obtuse, often emarginate at apex, flattened, membranous, slightly shorter than or equalling the outer; ovary sessile, ovate-oblong, 1-celled by abortion; styles 3, short, slender, one apparently never fully developed; fruit obovate, 1-seeded; seeds obovate, obtusely trigonous, smooth, with a vertical stria on the dorsal surface, reddish.

South Africa: Cape Province—Cape Div.: among grass and bush on ledges, south slope of the upper plateau, Table Mt., *Pillans*, 4898, ♂ and ♀.

56. R. cuspidatus, *Thunb. in Hoffm. Phytog. Blätter*, i, p. 8 (1803)!; *in Weber et Mohr, Archiv*, i, 26 (1804); *Pers., Syn. Pl.*, 607 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 331 (1811); ed. *Schultes*, 87 (1823); *Kunth, Enum.*, iii, 413 (1841); *Steud., Synops. Pl.*, ii, 254 (1855); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 418 (1875); *Mast. in DC. Monog. Phan.*, i, 233 (1878); *in Journ. Linn. Soc.*, xxi, 590, No. 6 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895); *Mast. in Fl. Cap.*, vii, 66 (1897): **R. squarrosus,** *Poir. in Lam., Encycl. Meth.*, vi, 174 (1804)!; [*Lam. Illus.*, tab. 804, fig. 1 (1798), nomen]; *Poir. in Lam., Tableau Encycl.*, 399 (1823); *Spreng., Syst. Veg.*, i, 186 (1825); *Steud. in Flora*, 1829, i, 133; *Nees in Linnaea*, v, 643 (1830); *op. cit.*, vii, 616 (1832); *Steud., Synops. Pl.*, ii, 249; *Durand et Schinz, op. cit.*, 511, excl. syn.: **R. triflorus,** *Steud. in Flora*, 1829, i, 133, non *Thunb.*!: **R. vaginatus,** *Nees in Linnaea*, vii, 615, nomen, non *Thunb.*: **R. aristatus,** var. *β*, *Kunth, Enum.*, iii, 383!, excl. syn. mult.: **R. Lucaeanus,** *Kunth, op. cit.*, 385!; *Steud., op. cit.*, 250: **R. Sprengelii,** *Mast. in Journ. Linn. Soc.*, viii, 224 (1865)!: **Schoenus capensis** (nomen confusum), *Linn. Herb. ex Mast., op. cit.*, xxi, 590, No. 3 (1885)!.

Stems caespitose or less often arising sporadically from creeping rhizomes, erect, slender, wiry, terete, more or less tubercled or rugose, sparingly or moderately branched from about the middle and upwards or simple, usually 3–5 dm. high; sheaths closely convolute in the lower parts, loose, somewhat expanded or erect-spreading in the upper, ovate to oblong-lanceolate, acute or acuminate, aristate, mostly 1–2 cm. long, coriaceous, with the upper margins prolonged into two hyaline-membranous lobes; male spikelets few in a spicate cyme or many in panicled cymes, oblong- or ovate-lanceolate, acute at both ends, many-flowered, about 1 cm. long; spathe at the base of the cyme sheath-like, the upper bract-like; bracts closely imbricate, elliptic, tapering into an awn, cartilaginous, broadly pale-membranous at the upper margins, dorsally scabridous on the upper parts, usually 6–8 mm. long; perianth sessile, with the apex often protruding, oblong-lanceolate, much compressed, about 5 mm. long; segments membranous; the outer lateral linear-lanceolate, acute, villous-carinate; the anterior lanceolate, acute; the inner oblong-lanceolate, acute or the posterior obtuse; filaments

broadly strap-shaped; female spikelets 1–3 in a spicate cyme, lanceolate, becoming ovate with fruiting, many-flowered, usually 1–1·5 cm. long; spathe bract-like, reaching to the middle or up to the apex; bracts as in the male, with an erect-spreading or recurved awn; perianth sessile, ovate, acuminate, 4–5 mm. long; segments acute, cartilaginous; the outer lateral lanceolate, densely villous on the carina; the anterior villous on the upper parts of its midrib; inner segments ovate-lanceolate; ovary rotundate, compressed, 2-celled; styles 2, united at base; capsule 2- or, by abortion, 1-seeded; seeds rotundate, scabridous, grey.

South Africa: without precise locality, *Thunberg*, ♂, *Sieber*, ♂, *J. D. Hooker*, ♀, *Berg*, ♂ and ♀, *Drège*, 44, ♀, 60, ♀, 9618, ♂, *Ecklon*, 320 partly, ♂, *Wallich*, ♂, *Harvey*, 388, ♀, 388*b*, ♂, 388*c*, ♀, *R. Brown*, ♂, *Verreaux*, ♂.

Cape Province—Cape Div.: Table Mt., *Burchell*, 39/1, ♂, *Milne*, 223, ♂, *Ecklon*, 848, ♂, *Bolus*, 2885, *MacOwan in Herb. Austr.-Afr.*, 1565, ♂, *Tyson in Herb. Austr.-Afr.*, 6058, ♂, *R. and T. Fries*, 2093, ♂, 3082, ♂, 3085, ♀, 3092, ♂ and ♀, *Moss*, 7837, ♂, 7850, ♂, *Garside*, 1491, ♂ and ♀; Devil's Peak, *Ecklon*, ♂ and ♀, *Bolus*, 4463, ♀, 4723, ♂, *Rehmann*, 925, ♀, 926, ♂; east slopes of Lion's Rump, *Burchell*, 120, ♂, *Pillans*, 4394, ♂; Lion's Head, *Pappe*, ♂, *Dümmer*, 899, ♂, *O. Kuntze*, ♀; Camp's Bay, *Burchell*, 854, ♂; Camp Ground Ridge, Rondebosch, *Pillans*, 4346, ♂; Constantia, *Zeyher*, ♂ and ♀; Vlakke Berg, *Wolley-Dod*, 2068, ♂ and ♀; Wynberg Hill, *Pillans*, 3406, ♂ and ♀, 4348, ♂ and ♀; Cape Flats, near Rondebosch, *Burchell*, 209, ♂; Cape Flats, *Alexander*, ♂, *Bolus*, 4453, ♂, *Page in Bolus Herb.*, 15948, ♂; Muizenberg, *Scott-Elliot*, 63, ♀; False Bay, *Robertson*, ♂.—Stellenbosch Div.: Stellenbosch, *Duthie*, 116, ♂; Dal Josephat, *Tyson*, 859, ♂.—Paarl Div.: between Paarl and Lady Grey railway bridge, *Drège*, 48 partly, ♂; French Hoek, *Phillips in Herb. Mus. Austr.-Afr.*, 8561, ♂, Bain's Kloof, *Bolus*, 4089, ♂.—Caledon Div.: between Genadendal and Donkerhoek, *Burchell*, 7926 partly, ♀; between Donkerhoek and Houwhoek, *Burchell*, 8017 partly, ♂; mountain near Grietje's Gat, *Zeyher*, ♂.—Tulbagh Div.: Tulbagh Kloof, *Ecklon and Zeyher*, ♂ and ♀, *MacOwan*, ♂; near Tulbagh Waterfall, *Schlechter*, 7514, ♂.—Ceres Div.: Mitchell's Pass, *Bolus*, 5482, ♀, 9667, ♀; Leeuwfontein, *Pearson in Sladen Mem. Exped.*, 3215*a*, ♂.—Clanwilliam Div.: Vogel Vley, *Schlechter*, 7920, ♀.—Swellendam Div.: dry hills at Breede River, *Burchell*, 7474, ♀.—Laingsburg Div.: Pieter Meintjes, *Marloth*, 9951, ♂.—Prince Albert Div.: Zwart Berg Pass, *Bolus*, 11662, ♂.—Willowmore Div.: mountains 6 miles from Willowmore, *Andreae*, 985, ♂; Modderfontein, *Andreae*, 1037, ♀.—Humansdorp Div.: without precise locality, *Burtt-Davy*, 12054, ♂; Kromme River Heights, *Bolus*, 2499, ♂ and ♀; Kouga, *Fourcade*, 3116, ♂.—Port Elizabeth Div.: Port Elizabeth, *Paterson*, 2130, ♂; Red House, *Paterson*, 300, ♂; Bethelsdorp, *Paterson*, 345, ♂; Earn Cliff, *Galpin*, 6394, ♀, 6395, ♂.

57. R. ocreatus, *Kunth, Enum.*, iii, 385 (1841)!; *Drège, Zwei Pfl. Documente*, 71 (1844); *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 225 (1865); *in DC. Monog. Phan.*, i, 234 (1878), partim; *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 67 (1897): **Calopsis peronata,** *Kunth, op. cit.*, 426, quoad pl. masc.!; *Steud., Synops.*, ii, 258, quoad pl. masc.: **R. Lehmannii,** *Nees in Linnaea*, xx, 241!, absque descriptione.

Stems erect, wiry, rather rigid in their lower parts, terete, more or less rugulose or smooth but then somewhat furrowed with drying, minutely white-speckled, simple or sparingly branched, 5–10 dm. high; sheaths in their lower parts loosely embracing the stem, erect-spreading in their upper half, oblong-lanceolate, acute or acuminate, mucronate or aristate, coriaceous, smooth or somewhat nervose, red-brown, chartaceous or membranous at the margins, mostly 2–3 cm. long; male spikelets many, in usually congested panicled cymes, lanceolate, acute, many-flowered, about 1 cm. long; spathe at the base of each cyme sheath-like but ovate-lanceolate, about as long as the cyme; bracts rather loosely imbricate, elliptic-ovate, tapering into a spreading or recurved awn, cartilaginous, lacerate and pale-membranous at the upper margins, 6–8 mm. long with the awn; perianth slightly exposed at its apex, sessile, lanceolate, 4–5 mm. long; outer segments linear-lanceolate, acuminate, membranous, the lateral minutely villous on the carina, the anterior glabrous; inner segments oblong-lanceolate, acute, hyaline, distinctly shorter; female spikelets 1–3 in a spicate cyme, lanceolate, acute, becoming ovate or elliptic with fruiting, many-flowered, 1·5–3 cm. long; spathe sheath-like, with its upper half spreading; bracts loosely imbricate, elliptic-ovate, acute, with a rigid, erect, ultimately spreading or recurved awn, coriaceous, lacerate and pale membranous at the upper margins, 1–1·4 cm. long with the awn; perianth slightly exposed at its apex, shortly stipitate, lanceolate, much compressed, 6–7 mm. long; outer segments lanceolate, cartilaginous, the lateral straight above the base, acuminate, densely villous along the entire carina, the anterior acute or obtuse, glabrous; inner segments oblong-lanceolate, subacute or obtuse, distinctly shorter, cartilaginous; ovary elliptic, compressed, 2-celled; styles 2, connate from the base up to near the middle; capsule usually 2-seeded; seeds elliptic, smooth.

South Africa: without precise locality, *Drège*, 42, ♂, *Marloth*, 3158, ♂.

Cape Province—Cape Div.: Chapman's Peak, *E. Kensit in Bolus Herb.*, 15942, ♂ and ♀, *in S.A. Nat. Herb.*, 1001, ♂ and ♀.—Ceres Div.: Vaalkloof, near Karroopoort, *Marloth*, 9103, ♂, 9104, ♀.—Worcester Div.: summit of Tafelberg, *Pillans in Bolus Herb.*, 14139, ♂ and ♀; Touws River, *Marloth*, 3154, ♀.—Clanwilliam Div.: Koudeberg, *Schlechter*, 8746, ♀, 8779, ♂ and ♀.—Van Rhynsdorp Div.: Bokkeveld Mts. at Uien Vley, *Zeyher*, 1207,

♂ and ♀, *Drège*, 2505, ♀.—Laingsburg Div.: Witteberg, near Matjesfontein, *Marloth*, 3148, ♀, *Compton*, 2751, ♂ and ♀.

58. R. fraternus, *Kunth, Enum.*, iii, 386 (1841)!; *Drège, Zwei. Pfl. Documente*, 79 (1844); *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 225 (1865); *in DC. Monog. Phan.*, i, 235 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 507 (1895); *Mast. in Fl. Cap.*, vii, 67 (1897): **R. ocreatus,** *Mast. in DC. Monog. Phan.*, i, 234, partim, non *Kunth.*

Stems erect, wiry, rather rigid at base, terete, smooth, moderately branched, mostly 2–4 dm. high; sheaths loosely stem-clasping at base, open in their upper parts, elliptic, rounded or obtuse, rarely subacute at apex, subulate-mucronate, coriaceous, smooth, shiny, chestnut-brown, pale-membranous at the upper margins, mostly 1·2–1·8 cm. long; male spikelets few in a dense spicate cyme, oblong-lanceolate, acute, many-flowered, 5–10 mm. long; spathe sheath-like but smaller; bracts closely imbricate, elliptic or rotundate, acute, shortly aristate, cartilaginous, pale-membranous at the upper margins, about 6 mm. long; perianth sessile, elliptic-oblong, about 4 mm. long; outer segments linear-oblong, acute, membranous, the lateral densely villous on the entire length of the carina; inner segments subacute, hyaline, the lateral linear-lanceolate, the posterior lanceolate; filaments strap-shaped; female spikelets 1–3, adjacent, in a spicate cyme, oblong-lanceolate, acute, many-flowered, 1·2–1·8 cm. long; spathe sheath-like, acute, aristate, half as long as or equalling the spikelet; bracts closely imbricate, elliptic, acute, shortly aristate, coriaceous, narrowly membranous at the upper margins, 1–1·2 cm. long; perianth hidden, shortly stipitate, lanceolate, 5–6 mm. long; outer segments ovate-lanceolate, acuminate, cartilaginous, dorsally rugulose, the lateral densely villous on the entire length of the carina, the anterior villous on the middle part of the carina; inner segments elliptic-ovate, acute, cartilaginous, membranous at the margins; ovary elliptic, compressed, 2-celled; styles 2, shortly connate from the base upwards; capsule 2- or, by abortion, 1-seeded; seeds rotundate, smooth.

South Africa: Cape Province—Stellenbosch Div.: Waagenmaakersberg, *Drège*, 46 partly, ♂, 47, ♀; mountains near Stellenbosch, *Drège*, 45, ♂; Sir Lowry's Pass, *Schlechter*, 7261, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 1623, ♂.

59. R. setiger, *Kunth, Enum.*, iii, 385 (1841)!; *Drège, Zwei Pfl. Documente*, 73 (1844); *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 228 (1865); *in DC. Monog. Phan.*, i, 236 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 72 (1897): **R. fuirenoides,** *Kunth, op. cit.*, 386!; *Drège, loc. cit.*; *Steud., loc. cit.*

Stems erect, terete, wiry, wrinkled and puncticulate, simple or sparingly branched, 3–5 dm. high, about 2 mm. in diameter at middle; sheaths

closely convolute, elliptic-oblong, acute, aristate, coriaceous, obscurely striate and tubercled, deeply membranous at the upper margins, 2·5–3·5 cm. long with the awn; male spikelets many, clustered in capitate cymes, lanceolate, acute, many-flowered, 5–7 mm. long; spathe at the base of the cyme open, oblong-lanceolate, acute, aristate, cartilaginous, hyaline at the margins, about 1·5 cm. long; bracts closely imbricate, rotundate, acute, aristate, cartilaginous, broadly membranous, at the margins, 1·5 mm. long in the body portion; the awn spreading or erect-spreading, compressed, 3–4 mm. long; perianth exposed in most of its upper half, sessile, ovate-lanceolate, 2–2·5 mm. long; segments oblong-lanceolate, acute, membranous; the outer lateral minutely villous on the carina; female spikelets solitary or 2 in a spicate cyme, lanceolate, acuminate or acute, many-flowered, 2·5–3 cm. long; spathe sheath-like, with an awn about 1·5 cm. long; bracts closely imbricate, elliptic-ovate or subrotund, acute, subcoriaceous, membranous at the margins, 6–7 mm. long in the body, with an erect-spreading awn about 7 mm. long; perianth stipitate, ovate, acuminate, much compressed, 5–6 mm. long; outer segments ovate-lanceolate, acuminate, cartilaginous; the lateral navicular, densely villous on the entire length of the carina; the anterior convex, glabrous; inner segments ovate-lanceolate, cartilaginous, membranous at the margins, distinctly shorter; the lateral acute, the posterior obtuse or truncate; ovary rotundate, compressed, 2-celled; styles 2, shortly connate at base; capsule 2-seeded.

South Africa: Cape Province—Clanwilliam Div.: near Honig Vley, on the Koude Berg, *Drège*, 2503, ♀, 2504, ♂.

60. R. hystrix, *Mast. in Journ. Linn. Soc.*, x, 276 (1868)!; *in DC. Monog. Phan.*, i, 252 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895); *Mast. in Fl. Cap.*, vii, 76 (1897).

Stems erect, stout and rigid, in their lower parts terete, finely rugulose, moderately or much branched in their upper parts, 1–1·5 m. high, up to 7 mm. in diameter at base, usually 3–4 mm. in diameter at the middle; sheaths closely convolute, elliptic, acute or acuminate, coriaceous, nervose-striate, brown, broadly pale-membranous at the upper margins, on the main stems 1·5–2·5 cm. long in the body, tapered at the apex into a straight awn about 1 cm. long; male spikelets many, in ample panicled cymes, lanceolate or cylindric-lanceolate, acute, straight or slightly curved, many-flowered, 1–1·5 cm. long; spathe sheath-like but broader and shorter, usually with the awn reaching to the apex of the spikelet; bracts closely imbricate, elliptic-ovate, acute, mucronate, cartilaginous, narrowly membranous at the margins, 5–6 mm. long; perianth hidden, subsessile, lanceolate or elliptic-lanceolate, 3–3·5 mm. long; outer lateral segments lanceolate, acute, villous on the carina, membranous distinctly shorter than the

others; anterior segment linear, acute; inner segments oblanceolate, obtuse, hyaline; female spikelets many, in spicate or panicled cymes, lanceolate or oblong, acute, many-flowered, 1·5–2·5 cm. long; spathe closely clasping the base of the spikelet, sheath-like but broader and shorter, with the awn reaching the apex of the spikelet or nearly there; bracts closely imbricate, elliptic-ovate or rotundate, tapering into an erect awn, coriaceous, purple-brown on exposed parts, pale-membranous at the upper margins, about 8 mm. long in the body, with a rigid awn 5–7 mm. long; perianth slightly exposed at its apex, shortly stipitate, lanceolate-ovate, 7–9 mm. long; segments lanceolate, cartilaginous; the outer lateral navicular, acuminate, densely villous on the entire length of the carina; the anterior acute, slightly villous on the upper half of the midrib; inner lateral segments, acute; the posterior obtuse; ovary obovate, compressed, 2-celled, with a pale horny apex; styles 2, stout and rigid, connate at base; capsule usually 1-seeded by abortion; seeds rotundate, laterally compressed, smooth, grey.

South Africa: Cape Province—Swellendam Div.: at Hottentots Fig Station, on the right bank of the Zonder Einde River, near its junction with the Breede River, *Burchell*, 7520 partly, ♂ and ♀.—Riversdale Div.: lower part of the Lange Bergen, near Kampsche Berg, *Burchell*, 6991, ♂ and ♀; near Riversdale, *Rust*, 394, 397, ♂; Garcia's Pass, *Bolus*, 11395, ♂, 11396, ♀, *Galpin*, 4794, ♂ and ♀; Glen Leith, south slopes of the Lange Bergen, *Muir*, 3303, ♀.

61. R. virgeus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 4, (1900)!.

Stems caespitose, erect, virgate, simple or sparingly branched, terete, smooth or nearly so, minutely white- or yellow-speckled, 2·5–4·5 dm. high, 1–1·5 mm. in diameter at base; sheaths closely convolute, oblong, acute or acuminate, aristate, coriaceous, deeply pale-membranous at the upper margins, red-brown, occasionally minutely yellow-speckled at base, about 2 cm. long; male spikelets several or many in spicate or subcapitate cymes, lanceolate or ovate-lanceolate, many-flowered, 6–10 mm. long; spathe ovate, obtuse, aristate, coriaceous, deeply membranous at the upper margin, with the awn overtopping the spikelet; bracts closely imbricate, ovate-elliptic, acute, mucronate, cartilaginous, 4·5–5·5 mm. long; perianth sessile, oblanceolate, about 4 mm. long; segments linear-lanceolate, acute, membranous; the outer lateral villous-carinate; female spikelets 1–4, adjacent in spicate or subcapitate cymes, oblong or oblanceolate, several-flowered, 1–1·5 cm. long, becoming elliptic or rotundate with fruiting; spathe as in the male or sheath-like; bracts closely imbricate, elliptic, subacute, subulate-mucronate or aristate, coriaceous, membranous at the upper margin, 6–12 mm. long; perianth shortly stipitate, oblong or ovate-oblong, 5·5–7 mm. long; segments lanceolate, acute, cartilaginous; the

outer lateral villous-carinate ; the anterior villous on a portion of its midrib ; ovary subquadrate, compressed, 2-celled ; styles 2, free or shortly connate at base ; capsule 2-seeded ; seeds rotundate, vertically striate, grey.

South Africa: Cape Province—Paarl Div. : mountains near Bain's Kloof, *Bolus*, 4099, ♂ and ♀.—Ceres Div. : Gydouw Berg, Koude Bokkeveld, *Schlechter*, 10231, ♂, 10232, ♀.—Worcester Div. : near Laken Vley, Matroosberg, *Phillips in Herb. Mus. Austr.-Afr.*, 11109, ♂ and ♀ ; upper slopes of the Matroosberg, *Marloth*, 3114, ♀ ; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17666, ♂ ; Omklaarberg, *Stokoe*, 1206, ♂, 1207, ♂.

62. R. Marlothii, *Pillans in Ann. Bolus Herb.*, iii, 83, tab. 5, fig. F (1921).

Stems erect, slender, occasionally wiry at base, terete, finely tubercled, sparingly branched from about the middle upwards, 3–5 dm. high ; sheaths closely convolute, oblong, acute or acuminate, aristate, coriaceous, nervose, red-brown, more or less yellow-speckled, deeply pale-membranous at the upper margins ; female spikelets terminal and solitary, oblong or elliptic-oblong, becoming elliptic or obovate with fruiting, 3–5-flowered, 8–10 mm. long ; spathe bract-like, with its awn reaching to shortly below the apex of the spikelet ; bracts closely imbricate, 8–9 mm. long, broadly elliptic, with rather prominent shoulders, with the apex of the coriaceous portion abruptly tapering into a stout mucro, with caducous, pale-membranous upper margins ; perianth slightly exposed at its apex, stipitate, oblong, 5–6 mm. long ; segments 4, 2 being inner and 2 outer, lanceolate, acute, cartilaginous ; the outer navicular, densely villous on the entire length of the carina ; ovary subquadrangular, much compressed, 2-celled ; styles 2, connate at base ; capsule 2- or, by abortion, 1-seeded.

South Africa: Cape Province—Laingsburg Div. : Witteberg, near Matjesfontein, *Marloth*, 3146, ♀, *Compton*, 2980, ♀.

Var. β, parviflorus (*Pillans*) ; female spikelets 6–10 mm. long ; bracts about 6 mm. long ; perianth 3–4 mm. long.

Cape Province—Laingsburg Div. : south slopes of low ridges west of Matjesfontein, *Pillans in Bolus Herb.*, 16475, ♀.

It is to be expected that plants will be found having an occasional inflorescence bearing 2 spikelets. So far as the present material shows, the most distinctive external character of this species is exhibited by the peculiar shoulders on the upper parts of each bract. The adverse arid conditions in which the variety was found growing may account for its smaller parts.

63. R. laniger, *Kunth, Enum.*, iii, 386 (1841) ! ; *Drège, Zwei Pfl. Documente*, 64, 66, 71 (1844) ; *Steud., Synops. Pl.*, ii, 250 (1855) ; *Mast. in Journ. Linn. Soc.*, viii, 230 (1865) ; *in DC. Monog. Phan.*, i, 238 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895) ; *Mast. in Fl. Cap.*, vii, 69 (1897).

Stems erect, wiry, terete, obscurely rugulose, faintly marked with transverse, wavy, brown lines, moderately branched, 3–6 dm. high, about 2 mm. in diameter at the middle; sheaths closely convolute, ovate-elliptic or oblong-elliptic, acute, subulate-mucronate, coriaceous, smooth and glossy, chestnut-brown, unspeckled or indistinctly speckled on the lower half, narrowly membranous at the upper margin, 1·5–2 cm. long on the main stems, in many cases with an exserted woolly scale in the axil; male spikelets several, in spicate or subcapitate cymes, occasionally in pairs or solitary, lanceolate, acute at both ends, several-flowered, 1–1·5 cm. long; spathe sheath-like, closely embracing the lower part of the spikelet and reaching to its middle; bracts closely imbricate, elliptic, obtuse, mucronate, cartilaginous, smooth, shiny, red-brown, about 6 mm. long; perianth slightly exposed at apex, stipitate, oblong, about 5 mm. long; outer segments linear-oblong, acute, membranous; the lateral navicular, villous on the upper half of the carina; inner segments linear-lanceolate, obtuse, hyaline; filaments broadly strap-shaped; female spikelets 1–3, approximately arranged in a spicate cyme, oblong-lanceolate or elliptic, becoming ovoid, 3-flowered, 8–15 mm. long; spathe as in the male; bracts loosely imbricate, elliptic or rotundate, abruptly acute, subulate-mucronate, coriaceous, smooth and shiny, 8–10 mm. long; perianth partly exposed at apex, on a villous stipe, oblong-lanceolate, about 6 mm. long; segments ovate-lanceolate, acute, cartilaginous; the outer lateral navicular, with long red hairs on the carina; ovary ovoid, compressed, 2-celled; styles 2, shortly connate at base; capsule 1-seeded by abortion; seeds closely marked with vertical striae.

South Africa: Cape Province—Caledon Div.: Hang Klip, *Mund*, ♂.—Tulbagh Div.: Winterhoek Mt., *Bolus*, 7493, ♀, 7504, ♂, *Marloth*, 3661, ♂.—Ceres Div.: Koude Bokkeveld, Gydouwberg, *Schlechter*, 10238, ♀; Matroosberg, *Phillips in Herb. Mus. Austr.-Afr.*, 11106, ♀.—Van Rhynsdorp Div.: Gift Berg, *Drège*, 51, ♂.—Laingsburg Div.: Witteberg, above Whitehill, *Compton*, 2753.—Prince Albert Div.: near Vrolykheid, on the Great Zwartberg, *Drège*, 36, ♀.

Var. β, distractus (*Pillans*): **R. distractus,** *Mast. in Fl. Cap.*, vii, 70 (1897)!; stems obsoletely tubercled.

Cape Province—Graaff-Reinet Div.: Gnadouw Berg, *Bolus*, 2633, ♂ and ♀.

64. R. coactilis, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 3 (1900)!.

Stems erect, slender, terete, smooth, minutely white-speckled, 1·5–2 dm. high, sparingly branched or simple; sheaths closely convolute, oblong, obtuse or acute, slender-aristate, coriaceous, ferruginous, smooth and glossy, unspeckled, mostly 1–1·5 cm. long, in most cases with an exserted, white, woolly scale in the axil; female spikelets terminal and solitary, at

first lanceolate, becoming elliptic-oblong or ovate, 2–several-flowered, about 1 cm. long; spathe bract-like; bracts tightly imbricate, elliptic, acute, aristate, cartilaginous, narrowly membranous at the margins, 5–7 mm. long; perianth usually with its apex exposed, on a short stipe, cuneate-oblong, about 4 mm. long; segments lanceolate, acute, cartilaginous; the outer lateral navicular, villous on the upper half of the carina; the anterior villous at the apex of the midrib; ovary elliptic, compressed, with a minutely pubescent, horny cap, 2-celled; styles 2, connate at base; capsule 2- or, by abortion, 1-seeded.

South Africa: Cape Province—Tulbagh Div.: hills near Tulbagh Waterfall, *Schlechter*, 7515, ♀.

The appearance of the type specimens suggests that they may have been gathered from a plant growing in adverse conditions. Further gatherings may, therefore, show greater measurements of most parts.

65. R. vilis, *Kunth, Enum.*, iii, 389 (1841)!; *Steud., Synops. Pl.*, ii, 251 (1855); *Mast. in Journ. Linn. Soc.*, viii, 231 (1865); *in DC. Monog. Phan.*, i, 241 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895); *Mast. in Fl. Cap.*, vii, 72 (1897).

Stems erect, slender, terete, wrinkled and obsoletely tubercled, simple or sparingly branched, 3–6 dm. high, about 1 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acute or acuminate, aristate, coriaceous at base, cartilaginous above, deeply membranous at the upper margins, mostly 1·5–2 cm. long; male spikelets many, in spicate or subpaniculate cymes, erect, subulate, very acute at apex, many-flowered, 1–1·5 cm. long; spathe ovate, acute, mucronate, cartilaginous, reaching to about the middle of the spikelet, with its upper parts membranous and deciduous; bracts closely imbricate, ovate or elliptic-ovate, acute, mucronate, cartilaginous, membranous at the margins, 3–4 mm. long; perianth hidden, sessile, oblong-lanceolate, 2–2·5 mm. long; outer segments lanceolate, acute, membranous; the lateral navicular, villous-carinate; inner segments oblong-lanceolate, acute, membranous; female spikelets either few, sometimes solitary, in a spicate cyme or many in subpanicled cymes, at first oblong, becoming elliptic, many-flowered, 1–1·5 cm. long; spathe closely embracing the base of the spikelet, ovate, acute, aristate, coriaceous, broadly membranous at the upper margins, reaching to about the middle of the spikelet; bracts closely imbricate, ovate-elliptic, acute, subulate-mucronate, cartilaginous, membranous at the upper margins, 4·5–6 mm. long; perianth hidden, stipitate, lanceolate, becoming elliptic with fruiting, 4–5 mm. long; outer segments lanceolate, acute, cartilaginous; the lateral navicular, apiculate, villous-carinate; the anterior glabrous; inner segments lanceolate, membranous; the lateral acute; the posterior obtuse; ovary rotundate, compressed, 2-celled; styles 2, connate from the base upwards

to about the middle; capsule 2- or, by abortion, 1-seeded; seeds elliptic, smooth, grey.

South Africa: without precise locality, *Drège*, 87, ♀.

Cape Province—Little Namaqualand: Kamiesberg, *Drège*, 2476, ♂ and ♀.

66. R. gossypinus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 3 (1900)!.

Stems caespitose, erect, slender, terete, obsoletely tubercled, sparingly branched, 3–4 dm. high; sheaths closely convolute, oblong-lanceolate, acute or acuminate, aristate, coriaceous, broadly pale-membranous at the upper margin, smooth, red-brown, 1·5–2 cm. long, in many cases with an exserted woolly scale in the axil; male spikelets 1–3, adjacent in a spicate cyme, oblong-lanceolate, many-flowered, about 1 cm. long; spathe closely embracing the spikelet, oblong-lanceolate, acute, aristate, coriaceous, membranous at the margins, smooth, red-brown, with the awn reaching to the apex of the spikelet or beyond it; bracts closely imbricate, elliptic, subacute, mucronate, cartilaginous, membranous at the margins, 5–6 mm. long; perianth linear-lanceolate, 5 mm. long; outer lateral segments linear-lanceolate, acuminate, villous on the upper half of the carina, membranous; anterior segment linear, acute, glabrous; inner segments linear, acute, hyaline, distinctly shorter than the outer; female spikelets solitary or in pairs, linear-oblong, many-flowered, 1–1·5 cm. long, becoming oblong with fruiting; spathe sheath-like, with its awn reaching to the apex of the spikelet; bracts closely imbricate, oblong-lanceolate, acute, aristate, coriaceous, membranous at the margins, minutely scabridous on exposed parts, 8–10 mm. long; perianth stipitate, lanceolate, 4–5 mm. long; segments lanceolate, acute, cartilaginous; the outer lateral villous-carinate; ovary rotundate, compressed, 2-celled; styles 2, connate at base and shortly upwards, with long red hairs on the outer surface; capsule usually 1-seeded by abortion; seeds rotundate, obtusely 3-angled, smooth, grey.

South Africa: Cape Province—Tulbagh Div.: Great Winterhoek, *Phillips*, 1655, ♂.—Ceres Div.: Onder Bokkeveld, *Drège*, 2488, ♂; Tafelberg, Koude Bokkeveld, *Schlechter*, 10082, ♂, 10083, ♀.

67. R. Sieberi, *Kunth, Enum.*, iii, 387 (1841)!; *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 235 (1865); *op. cit.*, x, 279 (1868); *in DC. Monog. Phan.*, i, 244 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 73 (1897): **R. intermedius,** *Kunth, op. cit.*, 388!; *Drège, Zwei Pfl. Documente*, 70, 109 (1844); *Steud., op. cit.*, 251; *Mast. in Journ. Linn. Soc.*, viii, 231; *in DC. Monog. Phan.*, i, 242; *Durand et Schinz, op. cit.*, 508; *Mast. in Fl. Cap.*, vii, 73: **R. subfalcatus,** *Nees ex Drège in Linnaea*, xx, 240 (1847)!, absque descriptione, excl. syn. *R. vilis, Kunth*; *Mast. in Journ. Linn. Soc.*, viii, 231; *in DC. Monog. Phan.*, i, 243; *Durand et Schinz, op. cit.*, 511; *Mast. in Fl. Cap.*,

vii, 75 : **R. bifidus,** *Drège in Linnaea,* xx, 241 !, non *Thunb.*, absque descriptione : **R. pycnostachyus,** *Mast. in Journ. Linn. Soc.*, viii, 232 ! ; *in DC. Monog. Phan.*, i, 243 ; *Durand et Schinz, op. cit.*, 510 ; *Mast. in Fl. Cap.*, vii, 74 : **R. Neesii,** *Mast. in Journ. Linn. Soc.*, viii, 232 ! ; *in DC. Monog. Phan.*, i, 244 ; *Durand et Schinz, op. cit.*, 509 ; *Mast. in Fl. Cap.*, vii, 75 : **R. Ecklonii,** *Mast. in Journ. Linn. Soc.*, viii, 236 ! ; *in DC. Monog. Phan.*, i, 250 ; *Durand et Schinz, op. cit.*, 506 ; *Mast. in Fl. Cap.*, vii, 75 : **R. divaricatus,** *Mast. in Journ. Linn. Soc.*, viii, 236 ! ; *op. cit.*, x, 279 : **R. spiculatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 4 (1900) ! : **R. consimilis,** *Mast., loc. cit.* !.

Stems arising sporadically from creeping rhizomes or caespitose, erect, slender, terete, obscurely wrinkled or almost smooth, moderately or sparingly branched throughout, rarely simple, 3–8 dm. high ; sheaths closely convolute, oblong- or elliptic-lanceolate, mucronate or aristate, with a deciduous, acute or obtuse, brown- or pale-membranous upper margin, acuminate or acute at the apex of the persistent portion, coriaceous, nervose, distinctly grey- or yellow-speckled on the greater part of the outer surface, mostly 1·5–2 cm. long ; male spikelets many, in panicled cymes, less often few in a spicate cyme, cylindric or subulate, acute, straight or curved, many-flowered, 5–10 mm. long ; spathe sheath- or bract-like ; bracts closely imbricate, elliptic or rotundate, acute to obtuse, mucronate, cartilaginous, with a deciduous, membranous upper margin, ferruginous, 2–4 mm. long ; perianth hidden, subsessile, oblong-elliptic, 2–2·5 mm. long ; segments membranous ; the outer lateral lanceolate, acute, navicular, villous-carinate ; the anterior oblong-lanceolate, obtuse, glabrous ; inner segments elliptic-oblong, obtuse ; female spikelets terminal and solitary or 2–4 in a spicate cyme, oblong or ovate-lanceolate, becoming ovate with fruiting, 2–8-flowered, 8–15 mm. long ; spathe sheath-like ; bracts closely imbricate, elliptic or rotundate, obtuse, aristate or mucronate, coriaceous, ferruginous, blackish at the apex, 5–8 mm. long ; perianth exposed at the apex, ovate or lanceolate-ovate, 4–5 mm. long ; segments acute, cartilaginous ; the outer lanceolate, the lateral navicular, densely villous on the carina, the anterior villous on the upper half of the midrib ; inner segments ovate ; ovary rotundate, compressed, 2-celled ; styles 2, connate at base ; capsule usually 1-seeded by abortion ; seeds rotundate, with vertical striae, grey.

South Africa : without precise locality, *Masson*, ♂, *J. D. Hooker*, ♀, *Sieber*, 228, ♂ and ♀, *Drège*, 81, ♀, 2470, ♂, 9617, ♂, *Wallich*, ♀, *Rehmann*, 2373, ♂.

Cape Province—Cape Div. : Table Mt., *Burchell*, 477, ♂, 536, ♂, *Marloth*, 3114, ♀, 3118, ♂, 3120, ♂, 3128, ♂, 3129, ♂, *R. Fries*, ♂ ; Silver Stream Ravine, on Table Mt., *Pillans*, 3130, ♂ and ♀, 3585, ♀ ; head of Kasteels Poort,

Pillans, 4388, ♀.—CALEDON DIV.: mountains at Villiersdorp, *Schlechter*, 9916, ♀; Palmiet River, *Schlechter*, 7452, ♂.—PAARL DIV.: French Hoek, *Schlechter*, 9313, ♂, 9314, ♀, 9267, ♂, 9268, ♀; Bain's Kloof, *Bolus*, 4083, ♂, 4090, ♀, 4090*b*, ♀, 4099, ♂ and ♀, 4104, ♀, *Schlechter*, 9163, ♂, *Garside*, 199, ♂ and ♀.—TULBAGH DIV.: Great Winterhoek, *Phillips*, 1654, ♀.—CERES DIV.: Mitchell's Pass, *Bolus*, 9669, ♂; Matroosberg, *Phillips in Herb. Mus. Austr.-Afr.*, 11112, ♂ and ♀; Bokkeveld, *C. L. Diels*, 615*a*, ♀.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 75, ♂, 79, ♂, 1616, ♂, 1621, ♀, 9615, ♀; mountains above Worcester, *Rehmann*, 2561, ♀, 2562, ♂.—PIQUETBERG DIV.: Piqueniers Kloof, *Schlechter*, 7945, ♂, 7946, ♀, 7948, ♂, 7948*a*, ♂.—CLANWILLIAM DIV.: Olifants River Mts., *Ecklon*, 76, ♂, *Stephens in Sladen Mem. Exped.*, 7140, ♂; between Long Vley and Heerenlogement, *Drège*, 2475, ♂ and ♀.—VAN RHYNSDORP DIV.: between Grassberg and Waterfals River, *Drège*, 2500 partly, ♀; Kerskop, *Schlechter*, 8796, ♂, 8797, ♀.—SUTHERLAND DIV.: Komsberg, *Marloth*, 3649, ♀.—LITTLE NAMAQUALAND: Kamiesberg, *Drège*, 73, ♀, 89 partly, ♀, 2490, ♂, *Pearson in Sladen Mem. Exped.*, 6240, ♂; Rietkloof, *Pearson in Sladen Mem. Exped.*, 5713, ♀; Brakdam, *Pearson in Sladen Mem. Exped.*, 5659, ♂; Zuurberg, near Anegas, *Pearson in Sladen Mem. Exped.*, 6252, sterile, 6267, ♂; Sneeuwkop, Bowesdorp, *Pearson in Sladen Mem. Exped.*, 5802, ♂; Vogelklip, *Pearson and Pillans in Sladen Mem. Exped.*, 5930, ♂, 5931, ♂; Klipfontein, *Pearson in Sladen Mem. Exped.*, 5953, ♀; Steinkopf, *Meyer in Marloth Herb.*, 6699, ♂ and ♀.—FORT BEAUFORT DIV.: Winterberg, *Drège*, 77, ♂.

Orange Free State: Mt. aux Sources, *Stokoe in Bolus Herb.*, 18785, ♂ and ♀.

Var. β, venustulus (*Pillans*): **R. venustulus,** *Kunth, Enum.*, iii, 388!; *Drège, Zwei Pfl. Documente*, 66; *Steud., Synops. Pl.*, ii, 250; *Mast. in Journ. Linn. Soc.*, viii, 231; *in DC. Monog. Phan.*, i, 240; *Durand et Schinz, Consp. Fl. Afr.*, v, 513; *Mast. in Fl. Cap.*, vii, 70: **R. scoparius,** *Kunth, op. cit.*, 390!; *Drège, loc. cit.*; *Steud., op. cit.*, 251; *Mast. in Journ. Linn. Soc.*, viii, 230; *in DC. Monog. Phan.*, i, 240; *Durand et Schinz, op. cit.*, 511. Leaf-sheaths in some or most cases with an exserted, white woolly scale in the axil; male and female spikelets usually smaller than those of average size in the species.

Cape Province—CERES DIV.: between the Bokkeveld and Hex River, *Drège*, 9616, ♂.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 1608 partly, ♀.—CLANWILLIAM DIV.: near Ezelsbank, Cedar Berg, *Drège*, 2496, ♀; Cedar Berg, *Primos in Marloth Herb.*, 11787, ♂, 11788, ♂.—LAINGSBURG DIV.: Constable, *Drège*, 9450, ♂ and ♀.

Var. γ, schoenoides (*Pillans*): **R. schoenoides,** *Kunth, op. cit.*, 391!; *Drège, op. cit.*, 52; *Mast. in Journ. Linn. Soc.*, viii, 228; *in DC. Monog. Phan.*, i, 237; *Durand et Schinz, op. cit.*, 510; *Mast. in Fl. Cap.*, vii, 71.

Leaf-sheaths broadly pale-membranous at the upper margins, indistinctly grey- or yellow-speckled on their lower parts.

Cape Province—Graaff-Reinet Div.: summit of Sneuwbergen, *Bolus*, 2584, ♀.—Aliwal North Div.: Witte Bergen, *Drège*, 50, ♀.

Basutoland—Leribe, *Dieterlen*, 192, ♀.

The diverse conditions of soil, moisture, and dryness which this species experiences in its extensive distribution are probably accountable for the presence or absence of woolly scales and the considerable variation in the number, shape, and size of the spikelets.

68. R. Gaudichaudianus, *Kunth, Enum.*, iii, 387 (1841)!; *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 237 (1865); in *DC. Monog. Phan.*, i, 246 (1878), excl. var.; *in Journ. Linn. Soc.*, xxi, 591, No. 26 (1885), non *R. bifidus, Thunb.*; *Durand et Schinz, Consp. Fl. Afr.*, v, 507 (1895), excl. var.; *Mast. in Fl. Cap.*, vii, 68 (1897), excl. var.: **R. dichotomus,** var., *Thunb., Diss. Rest.*, p. 21 (1788)!; *in Usteri, Delect.*, 55 (1790), quoad var.; *Thunb., Fl. Cap.*, ed. 1, p. 340 (1811), quoad vars. 2, 3, excl. syn. omn.; *ibid.*, ed. *Schultes*, 89 (1823), quoad vars. 2, 3, excl. syn. omn.; *Thunb., Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, Nos. 41, 42 (1875), non *R. triflorus, Rottb.*: **R. ferruginosus,** *Link ex Kunth, Enum.*, iii, 393!, quoad pl. masc.; *Drège, Zwei Pfl. Documente*, 79, 82 (1844); *in Linnaea*, xx, 240 (1847); *Steud., op. cit.*, 252; *Mast. in Journ. Linn. Soc.*, viii, 226, excl. syn. *R. ameles*; *op. cit.*, x, 279 (1868); *in DC. Monog. Phan.*, i, 245 (1878), excl. syn. *R. ameles*; *Durand et Schinz, op. cit.*, 506, excl. syn. *R. ameles*; *Mast. in Fl. Cap.*, vii, 67, excl. syn. *R. ameles*: **R. microstachyus,** *Nees ex Drège in Linnaea*, xx, 240!, nomen: **R. elatus,** *Mast. in Journ. Linn. Soc.*, viii, 226!; *in DC. Monog. Phan.*, i, 246; *Durand et Schinz, loc. cit.*; *Mast. in Fl. Cap.*, vii, 68.

Stems arising sporadically from creeping rhizomes, erect or shortly decumbent at base, rigid in the lower parts, slender in the upper, terete, nearly smooth, faintly puncticulate, about 1 m. high, with many flowering, slender or filiform, divided branches arising from about the middle and upwards; sheaths closely convolute at base, loose or erect-spreading in their upper parts, ovate, acute, mucronate, coriaceous, externally nervose, purplish, yellow-speckled, pale-membranous at the margins, mostly 1–2 cm. long; male spikelets few or many, in spicate or panicled cymes, lanceolate, oblong or cylindric, terete, straight or somewhat curved, many-flowered, usually 7–10 mm. long; spathe embracing the base of the spikelet, ovate, acute, mucronate, coriaceous, membranous at the upper margins, about $\frac{1}{3}$ as long as the spikelet; bracts closely imbricate, ovate or rotundate, acute, mucronulate, cartilaginous, narrowly membranous at the upper margins, 2–3 mm. long; perianth sessile, entirely hidden by the bract, elliptic, much compressed, about 1·5 mm. long; segments membranous;

the outer lateral navicular, oblong-lanceolate, acute, villous-carinate; the anterior elliptic, obtuse, glabrous; inner segments elliptic, obtuse, hyaline; female spikelets few or many in a spicate cyme, sometimes solitary and terminal, oblong, elliptic, or oblanceolate, often obovate with fruiting, 2–4-flowered, usually 6–10 mm. long; spathe as in the male but about half as long as the spikelet; bracts closely imbricate, rotundate, acute or obtuse, mucronate, coriaceous, at first narrowly membranous at the margins, mostly 4–6 mm. long; perianth shortly stipitate, elliptic or ovate, 2·5–4 mm. long; segments ovate or lanceolate-ovate, acute, cartilaginous; the outer lateral navicular, villous-carinate; ovary ovate, compressed, 2-celled; styles 2, united to shortly below the middle; capsule 2- or, by abortion, 1-seeded; seeds rotundate or orbicular, compressed, smooth.

South Africa: without precise locality; *Banks*, ♂, *R. Brown*, ♀, *Thunberg*, ♂, *Verreaux*, ♂, *Gaudichaud*, ♂, *Drège*, 1619, ♀, *J. D. Hooker*, ♂, *Admiral Grey*, ♀.

Cape Province—Cape Div.: Table Mt., *Rehmann*, 670, ♂, *MacOwan in Herb. Austr.-Afr.*, 1671, ♂, *Pillans*, 3129, ♂ and ♀; Devil's Peak, *Alexander*, ♂, *Bolus*, 7219, ♂ and ♀, *Wolley-Dod*, 2393, ♀; Lion's Head, *Berg*, ♂, *Pappe*, 78, ♂ and ♀; slopes above Camp's Bay, *Pillans*, 4382, ♂ and ♀; Kirstenbosch, *Page in Bolus Herb.*, 14335, ♂ and ♀; on the Muizenberg, *Tyson*, ♀; hills west of Simon's Town, *Pillans*, 3568, ♂ and ♀; Cape Flats, *Buchanan*, 157, ♂.—Stellenbosch Div.: Hottentots Holland Mts., *Zeyher*, ♂; Sir Lowry's Pass, *Schlechter*, 7819, ♂; Jonker's Hoek, *Garside*, 1404, ♂ and ♀.—Paarl Div.: mountains at Paarl, *Drège*, 93, ♂ and ♀, 1619*a*, ♀; French Hoek, *Moss*, 7138, ♂; Bain's Kloof, *Bolus*, 4084, ♂ and ♀.—Caledon Div.: mountains of Baviaans Kloof, Genadendal, *Burchell*, 7632 partly, ♂, 7778 partly, ♂; Zwartberg, *Pappe*, ♂ and ♀, *Guthrie in Bolus Herb.*, 16017, ♀; Houwhoek, *Schlechter*, 7389, ♀.—Piquetberg Div.: Pickeniers Kloof, *Schlechter*, 7951, ♂.—Tulbagh Div.: Tulbagh Kloof, *Burchell*, 1023, ♀; Tulbagh Waterfall, *Zeyher*, ♂, *Schlechter*, 7508, ♀.—Ceres Div.: Karroopoort, *Marloth*, 9051*b*, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 52, ♂, 58, ♂, 1619*b*, ♂; De Doorns, *Bolus*, 13215, ♀, 13216, ♀, 13217, ♂, 13218, ♂, 13219, ♂, 13220, ♀.—Montagu Div.: Langebergen, *Marloth*, 3118, ♂, 3119, ♀; mountains at Montagu, *Page in Bolus Herb.*, 16540, ♂ and ♀, *Mitchell in Bolus Herb.*, 16626, ♀.—Clanwilliam Div.: Brakfontein, Olifants River Valley, *Schlechter*, 10778, ♂; Olifants River Mts., *Schlechter*, 5120, ♀; Vogel Vley, *Schlechter*, 7920, ♂, 7923, ♀, 7924, ♀.—Riversdale Div.: summit of Mozambique Kop, above Garcia's Pass, *Muir*, 3213, ♀.—Prince Albert Div.: Zwart Berg, *Marloth*, 3170, ♂ and ♀; Seven Weeks Poort, *Phillips*, 1531, ♂ and ♀.

Var. β, luxurians (*Pillans*); stems usually stouter and taller, up to 1·5 m. high; sheaths closely clasping the stems or loose at apex; male

spikelets usually more numerous, in a more branched inflorescence and mostly cylindric; female spikelets generally more numerous and often larger when fruiting; seeds as in the species.

Cape Province—Worcester Div.: Hex River Mts., *Bolus*, 4234, ♀, 4235, ♂, 15949, ♂, 15950, ♀; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17665, ♂.—Montagu Div.: Lange Bergen, at Montagu, *Marloth*, 3118, ♂, 3119, ♀, *Page in Bolus Herb.*, 16540, ♂ and ♀, *Mitchell in Bolus Herb.*, 16626, ♀.—Laingsburg Div.: Zwarte Bergen, *Marloth*, 3170, ♂ and ♀.—Riversdale Div.: Glen Leith, foot of Lange Bergen, *Muir*, 3078, ♂ and ♀.—Willowmore Div.: Aasvogelberg, *Andreae*, 940, ♂ and ♀.—Alexandria Div.: Zwartwater Poort, *Burchell*, 3409, ♀.

R. Gaudichaudianus, like *R. Sieberi*, shows considerable variation in its vegetative and reproductive parts, several of its forms having been described as species. In cases of abnormal growth the branches and branchlets are often remarkably flexuose and the spikelets undersized.

69. R. subverticillatus, *Mast. in Journ. Linn. Soc.*, viii, 227 (1865)!; *op. cit.*, x, 279 (1868); *in DC. Monog. Phan.*, i, 248 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895); *Mast. in Fl. Cap.*, vii, 69 (1897): **R. ferruginosus,** *Kunth, Enum.*, iii, 393 (1841), quoad pl. fem., non *Link*; *Drège, Zwei Pfl. Documente*, 116 (1844): **Ischyrolepis subverticillata,** *Steud., Synops. Pl.*, ii, 249 (1855)!: **R. ameles,** *Steud., op. cit.*, 252!.

Stems caespitose, erect or declinate in their upper parts, stout and rigid in their lower parts, terete, faintly puncticulate and striate, about 1·5 m. high, usually 5–7 mm. in diameter at the middle, bearing in their upper parts very many verticillately arranged, filiform, divided branches; sheaths on the main stem loosely convolute, ovate, acute, stoutly mucronate, coriaceous, membranous at the margins, nervose-striate, mostly 3–5 cm. long; sheaths on the branches rather closely convolute, ovate or oblong-lanceolate, acute, mucronate or aristate, coriaceous or cartilaginous, broadly membranous at the upper margins, dorsally nervose, mostly 5–10 mm. long; male spikelets few or many in a spicate cyme, occasionally subpaniculate, oblong or linear-oblong, acute at both ends, straight or slightly curved, many-flowered, mostly 5–8 mm. long; spathe ovate or elliptic, obtuse, mucronate, broadly membranous at the upper margins, half as long as the spikelet or much shorter; bracts closely imbricate, broadly ovate or rotundate, at first obtuse, becoming acute with the loss of the deeply membranous upper margin, muticous or the lower mucronulate, cartilaginous, about 2 mm. long; perianth shortly stipitate, elliptic, about 1·5 mm. long; segments elliptic, obtuse, membranous; the outer lateral navicular, villous-carinate; the inner hyaline; female spikelets solitary or few in a spicate cyme, oblong, oblanceolate or obovate with fruiting, 3- or 4-flowered, mostly 6–8 mm. long; spathe clasping the base of the spikelet, ovate, acute,

mucronate, coriaceous, about half as long as the spikelet, with deciduous, membranous upper margins; bracts imbricate, rotundate, obtuse or the lower acute, coriaceous, at first broadly membranous at the upper margins, 3–4 mm. long; perianth hidden by its bract, on a short, stout stipe, elliptic, 2·5–3 mm. long; segments elliptic, acute, cartilaginous; the outer lateral navicular, villous-carinate; the anterior glabrous; ovary ovate, compressed, 2-celled; styles 2, united in the lower half; capsule 2- or, by abortion, 1-seeded.

South Africa: without precise locality, *Mund and Maire*, ♂, *Thom*, 919, ♀, *Verreaux*, ♂.

Cape Province—Stellenbosch Div.: Hottentots Holland Mts., *Zeyher*, ♂; Jonker's Hoek, *Garside*, ♀.—Caledon Div.: Nieuwe Kloof, Houwhoek, *Burchell*, 8112, ♂ and ♀; Genadendal, *Drège*, 1, ♂ and ♀.—Paarl Div.: Groot Drakenstein, *Milne in Bolus Herb.*, 16326, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 1620, ♂ and ♀.

This is the *Willdenowia teres* of European gardens, but not of Thunberg. It is also the **R. casuriniformis,** *Nees*, MS. in herbaria. As far as can be ascertained, this is the only species of the South African Restionaceae at present cultivated in Europe.

70. R. curviramis, *Kunth, Enum.*, iii, 395 (1841)!; *Drège, Zwei Pfl. Documente*, 82 (1844); *Steud., Synops.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 241 (1865); *in DC. Monog. Phan.*, i, 263 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895); *Mast. in Fl. Cap.*, vii, 78 (1897): **R. squarrosus.** *Sprengel ex Drège in Linnaea*, xx, 241 (1847), nomen, non *Poir.*

Stems caespitose, erect, slender, terete, slightly rough with minute tubercles, usually 2–4 dm. high, bearing from about the middle and upwards a few filiform, often flexuous, branches; sheaths closely embracing the stems, oblong-elliptic, truncate or rounded at apex, subulate-mucronate, coriaceous, obscurely tubercled on the lower parts, mostly 1–1·5 cm. long, with the upper margins produced into two deciduous, hyaline lobes; male spikelets several in a lax, spicate cyme, elliptic-oblong, several-flowered, 5–6 mm. long; spathe sheath-like, aristate, 5–6 mm. long with the awn; bracts imbricate, oblong-ovate, acute, subulate-mucronate, cartilaginous, membranous at the upper margins, 4–5 mm. long; perianth shortly stipitate, cuneate-oblong, about 4 mm. long; segments acute, membranous; the outer lateral linear-lanceolate, minutely villous-carinate; the anterior linear; inner segments linear-lanceolate, hyaline, very slightly exceeding the outer; female spikelets several or many, occasionally solitary, in a spicate cyme, lanceolate, becoming elliptic or obovate with the development of fruit, 1- or 2-flowered, 4–8 mm. long; spathe and bracts as in the male; perianth stipitate, linear-oblong, 3–4·5 mm. long; segments oblong-

lanceolate, acute, cartilaginous; the outer lateral minutely villous-carinate; ovary rotundate, compressed, 2-celled; styles 2, united to about the middle; capsule 1-seeded by abortion; seeds rotundate, with faint, vertical, grey ridges.

South Africa: without precise locality, *Drège*, 54, ♂.

Cape Province—Caledon Div.: Houwhoek, *Burchell*, 8064, ♀, *Schlechter*, 7410, ♀.—Paarl Div.: Bain's Kloof, *Bolus*, 4096, ♀.—Tulbagh Div.: near Tulbagh Waterfall, *Zeyher*, ♂; Zuurvlagte, near Tulbagh, *Schlechter*, 7466, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 57, ♂ and ♀, 1626, ♂; near Worcester, *Zeyher*, ♂; mountains above Worcester, *Rehmann*, 2567, ♂.—Clanwilliam Div.: Cedar Bergen, *Drège*, 2485, ♂; Blauw Berg, *Drège*, 2498, ♂; Ezelsbank, *Schlechter*, 8813, ♀; Kerskop, *Schlechter*, 8789, ♂.—Ceres Div.: Scurfdebergen, *Schlechter*, 9998, ♂ and ♀; mountains at Ceres, *Pearson in Sladen Mem. Exped.*, 3525, ♂.—Calvinia Div.: Waterkloof, near Calvinia, *Diels*, 757, ♂.—Riversdale Div.: Lange Bergen, *Schlechter*, 5671, ♂.

71. R. monanthus, *Mast. in Journ. Linn. Soc.*, viii, 238 (1865)!; *in DC. Monog. Phan.*, i, 264 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 79 (1897).

Stems caespitose, erect, terete, slender, obsoletely tubercled, sparingly branched, usually in the upper parts, or simple, 3–5 dm. high; sheaths closely convolute, oblong-elliptic, obtuse or acute, mucronate, coriaceous, smooth or nervose, ferruginous, 1–1·5 cm. long; female spikelets several or many in spicate or subpaniculate cymes, oblong or oblanceolate, becoming obovate, 1- or 2-flowered, 5–8 mm. long; spathe sheath-like, shorter than the spikelet; bracts closely imbricate, elliptic, obtuse or subacute, mucronate, coriaceous, thinner along the upper margins, 3–4 mm. long; perianth stipitate, oblong-elliptic, 3–3·5 mm. long; segments elliptic, acute, cartilaginous; the outer lateral navicular, densely villous on the entire length of the carina; the anterior villous on the upper half of the midrib; ovary rotundate, compressed, 2-celled; styles 2, connate from the base upwards about $\frac{1}{3}$ of their length; capsule exceeding the perianth, 2- or, more often, by abortion, 1-seeded; seeds rotundate, finely and closely pitted, grey.

South Africa: Cape Province—Ceres Div.: Bokkeveld, between Buffels River and Pedros Kloof, *Drège*, 2486, ♀.—Clanwilliam Div.: Koude Berg, *Schlechter*, 8778, ♀.—Calvinia Div.: Waterkloof, *Diels*, 758, ♀.

72. R. aridus, *Pillans in Ann. Bolus. Herb.*, iii, 84, tab. v, fig. *b* (1921).

Stems caespitose or arising sporadically from a creeping rootstock, erect, slender, terete, obsoletely tubercled, sparingly branched in the upper and lower parts or simple, 3–4 dm. high; sheaths closely convolute, oblong, acute in the coriaceous portion, aristate, coriaceous, smooth, pale-membranous at the margins, mostly 8–12 mm. long, with the awn, on the main

stems; male spikelets many in spicate or subpanicled cymes, oblong, tapered towards the base, many-flowered, 4–5 mm. long; spathe closely embracing the spikelet, elliptic, obtuse, aristate, coriaceous, smooth, membranous at the margins, equalling or shortly exceeding the spikelet in length; bracts closely imbricate, elliptic, obtuse, mucronate, cartilaginous, smooth, membranous at the upper margins, 3–4 mm. long; perianth hidden or slightly exposed at its apex, shortly stipitate, oblong-lanceolate, about 2 mm. long; segments oblong, acute, membranous; the outer lateral navicular, densely villous on the carina; the anterior slightly villous on the upper half of its midrib; female spikelets 1–3 in a spicate cyme, oblong, tapered towards the base, becoming rotundate with fruiting, 4- or 5-flowered, 6–8 mm. long; spathe tightly embracing the base of the spikelet, elliptic or rotundate, obtuse, with a scabridous awn, coriaceous, membranous at the upper margins, scarcely equalling the spikelet in length; bracts closely imbricate, ovate-rotundate, obtuse, with a scabridous mucro, cartilaginous, pale-membranous at the upper margins, 4–5 mm. long; perianth hidden or slightly exposed at its apex, stipitate, lanceolate, 2–2·5 mm. long; segments ovate-lanceolate, acute, membranous; the outer lateral navicular, densely villous on the carina; the anterior slightly villous on the midrib; ovary rotundate, compressed, 2-celled; styles 2, connate at base; capsule 2- or, by abortion, 1-seeded; seeds elliptic, subtrigonous, smooth, spotted purple-brown.

South Africa: Cape Province—Worcester Div.: hills at Touws River, *Bolus*, 7456, ♀, 9210, ♂ and ♀ (type), *Marloth*, 3157, ♂ and ♀.

73. R. rottboellioides, *Kunth, Enum.*, iii, 394 (1841)!; *Drège, Zwei Pfl. Documente*, 68 (1844); *Steud., Synops. Pl.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 239 (1865); *in DC. Monog. Phan.*, i, 261 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 510 (1895); *Mast. in Fl. Cap.*, vii, 77 (1897).

Stems caespitose, erect, terete, slender, with slightly raised, minute whitish specks, otherwise smooth, sparingly branched or simple, about 2 dm. high; sheaths closely convolute, elliptic-oblong, obtuse, mucronate, coriaceous, nervose, 1–1·5 cm. long, with a pair of deciduous, obtuse, membranous lobes at the upper margin; the mucro erect-spreading, subulate, scabrid; male spikelets 3–5 in a spicate cyme, oblong, 1-flowered, about 6 mm. long; spathe closely embracing and hiding most of the spikelet, ovate-elliptic, acute, with a scabrid mucro, coriaceous, nervose, broadly membranous at the upper margin, 5–7 mm. long; bracts closely imbricate, lanceolate, acute, membranous, about 6 mm. long; perianth lanceolate, equalling the bracts; segments linear-lanceolate, subacute, hyaline-membranous, glabrous; the anterior somewhat smaller than the lateral; the inner slightly shorter than the outer; female spikelets about 3 in a spicate cyme, oblong, 1-flowered, about 5 mm. long; spathe as in the male;

bracts 2, closely imbricate, oblong- or elliptic-lanceolate, acute, cartilaginous, membranous at the upper margins, usually minutely pubescent on the outer surface, 4–5 mm. long; perianth linear-lanceolate, about 4 mm. long; segments lanceolate, acute, cartilaginous, glabrous; the outer dorsally scabrid and somewhat keeled below the apex, exceeding the inner; ovary elliptic, compressed, 2-celled; styles 2, connate from the base upwards half their length; capsule 2-seeded; seeds elliptic, densely verrucose.

South Africa: Cape Province—Little Namaqualand, Kamiesberg, near Lily Fontein, *Drège*, 2494, ♂ and ♀.

Kunth, when describing the female flowers of this species, shows that he was doubtful about the nature of the perianth; and Masters states, in several places, that the perianth is absent. I have here described what, from the position and form of its parts, I judged to be the perianth.

74. R. sabulosus, *Pillans*, sp. nov.; culmis gracilibus teretibus laevibus ramosis; vaginis arcte convolutis elliptico-oblongis late obtusis mucronatis coriaceis marginibus superioribus late membranaceis; spiculis femineis 1–4 spicatim cymosis oblongis aculis, 2–5-floris; bracteis ellipticis acutis mucronatis cartilagineis marginibus superioribus membranaceis; perianthio oblongo; segmentis oblongo-lanceolatis subacutis membranaceis, exterioribus lateralibus villoso-carinatis; ovario elliptico biloculari; stylis duobus partibus inferioribus connatis; fructu abortu 1-loculari.

Stems rather widely spaced on creeping rhizomes, erect, slender, terete, smooth, minutely white-speckled, moderately branched below the middle and upwards, 2–4 dm. high; sheaths closely convolute, elliptic-oblong, rounded at apex, mucronate, coriaceous, mostly 8–15 mm. long on the main stems, with a pair of deciduous, membranous lobes at the upper margin; female spikelets 1–4 in a spicate cyme, oblong, acute at both ends, 2–5-flowered, 5–6 mm. long; spathe closely clasping and hiding most of the spikelet, broadly elliptic, subacute, mucronate, coriaceous, with a pair of membranous lobes at the apex; bracts tightly clasping the flowers, elliptic, acute, mucronate, cartilaginous, membranous and lacerate at the upper margins, 3·5–4 mm. long; perianth hidden, shortly stipitate, oblong, 2·5–3 mm. long; segments oblong-lanceolate, subacute, membranous; the outer-lateral navicular, villous-carinate, apiculate, distinctly exceeding the others; ovary elliptic, 2-celled; styles 2, connate from the base throughout about half their length; capsule 1-seeded by abortion.

South Africa: Cape Province—Cape Div.: sandy flats 4 miles east of Mowbray, *Pillans*, 4396, ♀.

75. R. tenuissimus, *Kunth, Enum.*, iii, 394 (1841)!; *Drège, Zwei Pfl. Documente*, 76, 82 (1844); *Steud., Synops. Pl.*, ii, 252 (1855); *Mast. in Journ. Linn. Soc.*, viii, 241 (1865); *in DC. Monog. Phan.*, i, 268 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 512 (1895); *Mast. in Fl. Cap.*, vii, 81

(1897): **R. nutans,** *Steud. in Flora*, 1829, pars 1, p. 134!: **R. Ludwigii,** *Steud., Synops.*, ii, 254!; *Mast. in Journ. Linn. Soc.*, viii, 239; in *DC. Monog. Phan.*, i, 268; *Durand et Schinz, op. cit.*, p. 508; *Mast. in Fl. Cap.*, vii, 80.

Stems caespitose or in small tufts on creeping rhizomes, erect or the lateral sometimes decumbent, filiform, terete, smooth, wrinkled, or with small whitish tubercles, moderately or much branched from below the middle and upwards, mostly 1–3 dm. high; the branches very slender, generally flexuose; sheaths closely convolute, oblong- or elliptic-lanceolate, acute or obtuse, subulate-mucronate, coriaceous, membranous at the upper margins, mostly 5–10 mm. long; male spikelets few in a spicate cyme or solitary and terminal, oblong or oblanceolate, 1–3-flowered, 2–4 mm. long; spathe sheath-like, ovate, scarcely as long as the spikelet; bracts imbricate, ovate, obtuse, mucronate, cartilaginous, membranous at the margins, 2–2·5 mm. long; perianth subsessile, oblong, subterete, about 2 mm. long; segments 4–6, oblong or oblong-lanceolate, acute or subacute, membranous; the outer lateral glabrous, often with a scabrid midrib and apicula; stamens sometimes 2; filaments broadly strap-shaped; female spikelets solitary and terminal or 2 or 3 in a spicate cyme, oblong or oblong-lanceolate, becoming obovate or cuneate with fruiting, 1- or 2-flowered, about 3 mm. long; spathe as in the male; bracts closely imbricate, ovate, acute, mucronate, cartilaginous, membranous at the margins, about 2 mm. long; perianth subsessile, oblong, somewhat compressed, 1·75–2 mm. long; segments 4 or 6; the outer lanceolate, acute, glabrous, often apiculate, cartilaginous; the inner ovate or ovate-lanceolate, membranous; ovary elliptic, compressed, 2-celled; styles 2, united in their lower half; capsule oblique, 1-seeded by abortion; seeds rotundate, tessellate, grey.

South Africa: without precise locality; *Ludwig in Fielding Herbarium, Oxford*, ♀.

Cape Province—Cape Div.: damp cliffs at head of Echo Valley, Table Mt., *Pillans*, 4210, ♂ and ♀; Constantia, *Zeyher*, ♂; mountains above Simon's Town, *Zeyher*, ♂ and ♀.—Stellenbosch Div.: Hottentots Holland Mts., *Zeyher*, ♂ and ♀; flats between the Strand and Eerste River, *Pillans*, 4911, ♀.—Caledon Div.: without precise locality, *Guthrie in Bolus Herb.*, 16043, ♂; Houwhoek, *Schlechter*, 7790, ♀; Hermanus, *Bolus*, 16044, ♂.—Tulbagh Div.: Tulbagh Waterfall, *Drège*, 1970, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 1625, ♂.—Little Namaqualand: Bowesdorp, *Pearson in Bolus Herb.*, 16900, ♀.

The variability of the surface of the stems seems to be due to the different conditions in which the species grows. In moist, elevated situations the surface is usually smooth or slightly wrinkled; on open, dry slopes and low flats it is wrinkled or tubercled.

76. R. Duthieae, *Pillans*, sp. nov.; culmis gracilibus vel filiformibus dense tuberculatis teretibus remosis vel simplicibus; vaginis arcte convolutis oblongis mucronatis coriaceis marginibus superioribus late hyalino-membranaceis; spiculis femineis paucis vel multis spicatim cymosis oblongis vel oblanceolatis 1- vel 2-floris; spatha late elliptico; bracteis oblongo-lanceolatis acutis; perianthio oblongo vel cuneato-oblongo; segmentis exterioribus 2 lanceolatis acutis cartilagineis glabris, interioribus 2 ovato-lanceolatis; ovario elliptico compresso biloculari; stylis duobus partibus inferioribus connatis.

Stems caespitose or arranged in small tufts on creeping rhizomes, erect, slender or filiform, terete, closely and minutely tubercled, moderately branched or simple, 1·5–2 dm. high; sheaths closely convolute, oblong, rounded and mucronate at apex, coriaceous, externally rugulose, mostly 7–10 mm. long, with two deciduous, hyaline-membranous lobes at the upper margins; female spikelets several or many, approximately arranged in a spicate cyme, oblong or oblanceolate, 1- or 2-flowered, about 4 mm. long; spathe closely embracing the spikelet, broadly elliptic, obtuse, mucronate, coriaceous, deeply membranous at the upper margins, dorsally scabridous, 2–4 mm. long; bracts 3, closely imbricate, oblong-lanceolate, acute, cartilaginous, membranous at the apex, 2–3 mm. long; perianth subsessile, oblong or cuneate-oblong, somewhat compressed, minutely puberulous at base, 3 mm. long; outer segments 2, lateral, lanceolate, acute, cartilaginous, slightly angular on the back, glabrous; inner segments 2, anterior and posterior, ovate-lanceolate, acute, membranous; ovary elliptic, compressed, 2-celled, surmounted by a firm stylopodium; styles 2, thickened and united at base, free in the upper half; capsule 2- or, by abortion, 1-seeded.

South Africa : Cape Province—Stellenbosch Div.: slope of first river terrace, Stellenbosch Flats, *Duthie*, 1604, ♀.

77. R. cincinnatus, *Mast. in Journ. Linn. Soc.*, viii, 240 (1865)!; *in DC. Monog. Phan.*, i, 267 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895); *Mast. in Fl. Cap.*, vii, 79 (1897): **R. vimineus** β, *Thunberg, Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 44 (1875)!, non *Rotth.*

Stems caespitose or arising sporadically from creeping rhizomes, erect or the lateral often shortly decumbent at base, terete, slender in the lower half, filiform upwards, closely and minutely tubercled, 2–4 dm. high, producing from near the base and upwards many much-divided, often flexuous, filiform branches; sheaths closely convolute, oblong or oblong-elliptic, acute, mucronate, dorsally rugulose, mostly 6–10 mm. long, with two deciduous, pale-membranous lobes arising from the upper margins; male spikelets few in a spicate cyme, lanceolate or ovate, many-flowered, 3–5 mm. long; spathe, embracing the spikelet, rotundate, mucronate, broadly membranous at the upper margins, about half as long as the spikelet; bracts

imbricate, broadly ovate, acute, mucronate, cartilaginous, membranous at the upper margins, 2–3 mm. long; perianth elliptic, about 1·75 mm. long; segments oblong-lanceolate, acute, membranous, subequal; the outer lateral finely villous-carinate; female spikelets terminal and solitary or occasionally 2 in a spicate cyme, elliptic, becoming obovate or broadly cuneate with fruiting, 1- or 2-flowered, 3–5 mm. long; spathe as in the male; bracts rotundate, obtuse, subulate-mucronate, coriaceous, nervose, membranous at the margins, 3–4 mm. long; perianth on a papillate stipe, elliptic, about 3 mm. long; segments oblong-lanceolate, acute, cartilaginous; the outer lateral villous-carinate on the upper half; ovary ovate, compressed, 2-celled; styles 2, united upwards to shortly above the base; capsule 1-seeded by abortion.

South Africa : without precise locality, *Thunberg*, ♀.

Cape Province—Cape Div.: mountains near Simon's Town, *Ecklon and Zeyher*, ♂ and ♀, *Pillans*, 3603, ♂ and ♀; on Table Mt., *Pappe*, ♂ and ♀; slopes of Table Mt., above Orange Kloof, *Schlechter*, 348, ♂.

78. R. Eleocharis, *Nees ex Mast. in Journ. Linn. Soc.*, viii, 238 (1865)!; *in DC. Monog. Phan.*, i, 266 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 506 (1895); *Mast. in Fl. Cap.*, vii, 81 (1897).

Stems arising sporadically from creeping, underground rhizomes which often descend to the depth of 2 dm. in sand, erect or decumbent at base, slender, terete, smooth or minutely scaberulous, 2–4 dm. high, producing from near the base and upwards many, much-divided, filiform branches; sheaths closely convolute, elliptic, obtuse or subacute, with a subulate, somewhat twisted and flexuose mucro, coriaceous, nervose, those on the main stem about 5–8 mm. long; male spikelets 1–3, in spicate cymes, lanceolate or linear-lanceolate, acute at apex, many-flowered, 5–8 mm. long; spathes tightly embracing the spikelets, broadly ovate, obtuse, subulate-mucronate, coriaceous, with membranous margins, 2–3 mm. long; bracts closely imbricate, spathe-like, cartilaginous, the upper often without a mucro; perianth ovate-oblong, scarcely 2 mm. long; segments oblong-lanceolate, acute, membranous, subequal; the outer lateral villous-carinate; the inner convolute; female spikelets terminal and solitary, elliptic-oblong, becoming obovate, acute at apex, always tapered at base, 2-flowered, about 5 mm. long; spathes as in the male; bracts closely imbricate, broadly ovate-oblong, obtuse, subulate-mucronate, cartilaginous, broadly membranous at the margins, 3–3·5 mm. long; perianth oblong-lanceolate, about 3 mm. long; segments oblong-lanceolate, acute, membranous, subequal; the outer lateral villous-carinate; the anterior dorsally rounded, with a few hairs on the midrib; inner segments with convolute margins; ovary ovate, minutely puberulous on its upper parts, 2-celled; styles 2, united from the base upwards to shortly below the middle, minutely puberu-

lous at the base ; capsule 2-seeded or, by abortion, 1-seeded ; seeds smooth, grey.

South Africa : without precise locality, *Rehmann*, 1802, ♀.

Cape Province—Cape Div. : sand dunes on the Cape Flats, *Bolus*, 4433, ♂, *Schlechter*, 556, ♀ ; Zeekoe Vley, *Pappe in Herb. Mus. Austr.-Afr.*, 12819, ♂ and ♀, *Zeyher in Herb. Mus. Austr.-Afr.*, 12924, ♂, *Pillans*, 2946, ♂, 2947, ♀ ; Retreat, *Wolley-Dod*, 2599, ♂ ; between Little Lion's Head and Karbonkel Berg, *Pillans*, 4345, ♂ ; Elsje's Peak, *Pillans*, 4350, ♂ ; mountains at Simon's Town, *Guthrie*, 1314, ♂ and ♀.—Stellenbosch Div. : Kuils River, *Marloth*, 3134, ♀.—Riversdale Div. : Still Bay, *Muir in Galpin Herb.*, 5402, ♀ ; Milkwood Fontein, *Muir*, 3109, ♂ and ♀.—Knysna Div. : Plettenberg Bay, *Schlechter*, 5934, ♀ ; Buffalo Bay, *Duthie*, 839*a*, ♂.—Port Elizabeth Div. : Port Elizabeth, *Potts*, 301, ♂ ; Humewood, *Paterson*, 1009, ♀, 1100, ♀.—Bathurst Div. : Port Alfred, *Salisbury*, 65, ♀, 111, ♀, *Tyson*, 138, ♂, *Galpin*, 2935, ♂.—East London Div. : coast near East London, *Thode in Natal Govt. Herb.*, 4849, ♂.

79. R. leptocladus, *Mast. in Journ. Linn. Soc.*, viii, 241 (1865) ! ; *op. cit.*, x, 279 (1868) ; *in DC. Monog. Phan.*, i, 265 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895) ; *Mast. in Fl. Cap.*, vii, 80 (1897) : **R. penicillatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 5 (1900) !.

Stems arising sporadically from creeping underground rhizomes, erect, slender, rigid in the lower parts, terete, rugulose, 2–6 dm. high, bearing from near the base and upwards many verticillately or subverticillately arranged, much divided, very slender branches ; sheaths closely clasping the stem, oblong, acute, subulate-mucronate, coriaceous, broadly membranous at the upper margins, usually 1–1·5 cm. long, those on the branches much smaller, with a slender awn ; male spikelets 1 or 2, in spicate cymes, narrowly oblong-lanceolate, very acute at apex, many-flowered, 3–12 mm. long ; spathes bract-like, up to 4 mm. long ; bracts closely imbricate, ovate-oblong, acute, subulate-mucronate, cartilaginous, pale-membranous at the upper margins, 1·5–3 mm. long ; perianth sessile, lanceolate-oblong, about equal with the bract ; outer lateral segments linear-lanceolate, acute, villous-carinate ; the anterior linear, flattened, glabrous, distinctly shorter than the lateral ; inner segments convolute, linear, hyaline, slightly shorter than the outer ; female spikelets terminal, solitary, resembling the male but becoming obovate or cuneate with the development of fruit, 1-flowered ; spathes and bracts as in the male ; perianth sessile, ovate-lanceolate, about 2 mm. long ; segments sometimes only 4, oblong-lanceolate, acute, cartilaginous, subequal ; the outer lateral villous-carinate, the others dorsally rounded, glabrous ; ovary oblong, 2-celled ; styles 2, united up to the middle ; fruit 1-seeded by abortion.

South Africa : without precise locality, *Drège*, 3, ♀.

Cape Province—Bredasdorp Div.: Rattel River, *Schlechter*, 9720, ♂ and ♀, *Bolus*, 8698, ♂.—Riversdale Div.: Milkwood Fontein, *Galpin*, 4788, ♂, *Muir*, 3672, ♂.—Knysna Div.: on sand hills near west end of Groene Vley, *Burchell*, 5589, ♂, 5652, ♂, 5672, ♂; Buffalo Bay, *Keet*, 868, ♂, *Duthie*, 839, ♂.—Humansdorp Div.: seashore at Eerste River, *Fourcade*, 1198, ♂ and ♀.

80. R. triflorus, *Rottb., Programm.*, p. 10 (1772); *ejusd. Descr. et Icon.*, p. 3, t. 2, fig. 2 (1773); *Linn., Syst. Veg.*, ed. 13, p. 738 (1774); ed. 14, p. 882 (1784); ed. 15, p. 924 (1797); *Richter, Syst. Gen. et Sp.*, 970 (1840); *Kunth, Enum.*, iii, 391 (1841), quoad pl. masc., excl. syn. *Thunb.*; *Drège, Zwei Pfl. Documente*, 87 (1844); *Steud., Synops. Pl.*, ii, 251 (1855); *Mast. in Journ. Linn. Soc.*, viii, 234 (1865), excl. syn. *Thunb. Spreng.*; *op. cit.*, x, 279 (1868); *in DC. Monog. Phan.*, i, 249 (1878); *in Journ. Linn. Soc.*, xxi, 590, No. 10 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 512 (1895), excl. syn. *R. dichotomus*, Thunb.; *Mast. in Fl. Cap.*, vii, 73 (1897), excl. syn. *Thunb. Spreng.*: **R. bifidus,** *Nees in Linnaea*, vii, 615 (1832), nomen, non *Thunb.*, excl. var. β et syn. *R. monostachyus*, Steudel: **R. Kunthii,** *Steud., Synops. Pl.*, ii, 251!: **R. araneosus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 3 (1900)!.

Stems caespitose, erect, filiform, terete, rugose and finely tubercled, sparingly branched or simple, 2–5 dm. high; sheaths closely convolute, oblong-lanceolate, acute, aristate, purplish, yellow-speckled, mostly 8–12 mm. long, with a pair of membranous lobes arising from the upper margins; male spikelets many, in spicate or panicled cymes, subulate, very acute at apex, straight or curved, many-flowered, 1–1·5 cm. long; spathe closely embracing the base of the spikelet, elliptic, acute, coriaceous, deeply membranous at the upper margins, scarcely reaching to the middle of the spikelet; bracts closely imbricate, elliptic, obtuse, cartilaginous, pale-membranous at the margins, 4–5 mm. long; perianth hidden, subsessile, lanceolate, 3 mm. long; segments lanceolate, acute, membranous; the outer lateral navicular, villous on the upper half of the carina; the anterior glabrous; filaments conspicuously strap-shaped; female spikelets like the male but usually fewer, occasionally with hermaphrodite flowers in the axils of the lower bracts; spathes as in the male; bracts as in the male but 3–4 mm. long; perianth hidden, shortly stipitate, lanceolate, about 3 mm. long; segments occasionally 4, like those in the male but the outer lateral more densely villous on the carina; ovary elliptic, compressed, 2-celled; styles 2, united upwards to shortly above the base; capsule 2- or, by abortion, 1-seeded.

South Africa: without precise locality, *Sieber*, 115, ♀, *Verreaux*, ♂.

Cape Province—Cape Div.: Camp's Bay, *Burchell*, 853, ♂; Lion's Head, *Pappe*, ♀, *Pillans*, 3385, ♂, 3386, ♀; Lion's Rump, *Zeyher*, 4342, ♂ and ♀; Table Mt., *R. and T. Fries*, 3087, 3088; Devil's Peak, *Ecklon*, 845, ♀.—Caledon

Div.: between Donkerhoek and Houwhoek Mts., *Burchell*, 8017 partly, ♂; between Genadendal and Donkerhoek, *Burchell*, 7926 partly, ♂; Houwhoek, *Schlechter*, 7444, ♀; Bot River, *Guthrie in Bolus Herb.*, 16011, ♀.—Paarl Div.: mountains at Paarl, *Drège*, 69, ♂ and ♀, 1617, ♂ and ♀.—Riversdale Div.: hills near Zoetmelks River, *Burchell*, 6800, ♂; hills near Riversdale, *Muir*, 3094, ♀.—Knysna Div.: Knysna, *Pappe in South African Mus. Herb.*, 12869, ♂; base of Knysna Heads, *Schönland*, 3406, ♀.—Port Elizabeth Div.: Port Elizabeth, *Paterson*, 1154, ♂, 2130, ♀.

81. R. macer, *Kunth, Enum.*, iii, 390 (1841)!; *Drège, Zwei Pfl. Documente*, 70 (1844); *Steud., Synops. Pl.*, ii, 251 (1855); *Mast. in Journ. Linn. Soc.*, viii, 235 (1865); *in DC. Monog. Phan.*, i, 251 (1878), partim; *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895); *Mast. in Fl. Cap.*, vii, 77 (1897), partim.

Stems caespitose, erect, slender, terete, very finely tubercled, sparingly branched, about 3 dm. high; sheaths closely convolute, 1–1·5 cm. long, oblong, rounded or truncate at the apex of the firmer portion, subulate-mucronate, coriaceous, with a pair of deciduous, hyaline-membranous lobes at the upper margin, rugulose on the lower parts; male spikelets 1–4 in a spicate cyme, lanceolate, tapered at base, several-flowered, 8–12 mm. long; spathe sheath-like, closely embracing the spikelet, to about the middle of which its mucro reaches; bracts closely imbricate, ovate-lanceolate, acute, mucronate, cartilaginous, about 6 mm. long; perianth hidden, sessile, lanceolate, 4·5–5 mm. long; segments membranous, acute; the outer linear, the lateral minutely setaceous on the upper parts of the midrib; inner segments linear-lanceolate, slightly exceeding the outer; female spikelets 1–3 in a spicate cyme, oblong-lanceolate, several-flowered, 1–1·5 cm. long; spathe sheath-like; bracts closely imbricate, elliptic-lanceolate, acute, subulate-mucronate, cartilaginous, deeply membranous at the upper margins, 6–7 mm. long; perianth subsessile, oblong, 4–6 mm. long; outer segments lanceolate, acute, apiculate, cartilaginous; the lateral villous-carinate, the anterior glabrous; inner segments ovate-lanceolate, acute, cartilaginous; ovary elliptic, compressed, 2-celled; styles 2, connate in the lower half, hispidulous at base.

South Africa: Cape Province—Van Rhynsdorp Div.: Onder Bokkeveld, near Groen River and Waterval, *Drège*, 2487, ♂ and ♀.—Swellendam Div.: right bank of the Zonder Einde River, *Burchell*, 7520 partly, ♀.

82. R. Wallichii, *Mast. in Journ. Linn. Soc.*, viii, 234 (1865)!; *in DC. Monog. Phan.*, i, 251 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895); *Mast. in Fl. Cap.*, vii, 76 (1897): **R. humilis,** *Pillans in Ann. Bolus Herb.*, iii, tab. v, fig. E (1921).

Stems crowded on a shortened creeping rootstock, erect, slender, terete, rugulose or smooth, occasionally purple-speckled, sparingly branched in

the lower half and upwards, 2–6 dm. high; sheaths closely convolute, elliptic-oblong, obtuse, subulate-mucronate, coriaceous, membranous at the upper margins, mostly 1–1·5 cm. long; female spikelets several or many in a spicate cyme, subulate, acute at both ends, several- or many-flowered, 6–10 mm. long; spathe closely embracing the base of the spikelet, ovate-elliptic, obtuse, mucronate, coriaceous, membranous at its margins, reaching to about the middle of the spikelet; bracts closely imbricate, elliptic, obtuse, mucronate, cartilaginous, broadly membranous at the upper margins, 3–3·5 mm. long; perianth hidden, shortly stipitate, lanceolate or oblong, 2·5–3 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, villous-carinate; inner segments ovate, membranous; the lateral acute or obtuse; the posterior obtuse; ovary elliptic, compressed, 2-celled; styles 2, shortly connate at base.

South Africa: without precise locality, *Wallich*, ♀.

Cape Province—Caledon Div.: Houwhoek, *Schlechter*, 7416, ♀, *Otto Kuntze*, ♀.—Ceres Div.: Skurfdebergen, Koude Bokkeveld, *Schlechter*, 10218, ♀.—Clanwilliam Div.: sandbanks in bed of Olifants River below Kradouw Krantz, *Pearson in Sladen Memorial Exped.*, 5290, ♀, *Pillans in same*, 5369, ♂, 5371, ♂.—Swellendam Div.: right bank of Zonder Einde River, *Burchell*, 7520 partly, ♀.

The two male plants cited above are in the Kew Herbarium; though I have examined them and do not doubt their identity I am, by an oversight, unable to include a description of them here.

83. R. paludosus, *Pillans in Ann. Bolus Herb.*, iii, 142 (1922).

Stems in dense tufts or crowded on short creeping rhizomes, erect or somewhat decumbent at base, very slender, clothed at base with chartaceous, brown scales, almost smooth, simple or sparingly branched, 2–4 dm. high; sheaths closely convolute, oblong, obtuse, aristate, coriaceous, membranous at the upper margins, mostly 1–1·2 cm. long; male spikelets many, in lax, shortly branched spicate cymes, linear-oblong, acute at both ends, 2- or 3-flowered, 5–7 mm. long; spathe ovate, obtuse, mucronate, cartilaginous, broadly pale-membranous at the upper margin, reaching to shortly above the middle of the spikelet; bracts few, closely embracing the flowers, lanceolate, obtuse, tapered towards the base, cartilaginous, broadly pale-membranous at the upper margins, straw-coloured, 4–5 mm. long, the lower mucronate, the upper muticous; perianth partly exposed in its upper half, sessile, lanceolate or oblong, occasionally slightly compressed laterally, 3·5–4 mm. long; segments lanceolate, membranous, glabrous; the outer acuminate, the lateral subnavicular; inner segments acute, much shorter; filaments broadly strap-shaped; female spikelets several or many, in spicate or shortly branched cymes, subulate, becoming oblong or oblanceolate with fruiting, 1- or rarely 2-flowered, 4–5 mm. long; spathe as in the male but

obscuring most of the spikelet and often with its mucro overtopping the spikelet; bracts 2 or 3, lanceolate, acute, cartilaginous, broadly membranous at the apex, 3–4 mm. long; perianth hidden, partly exposed during the fruiting period, shortly stipitate, subulate, becoming oblanceolate with fruiting, subterete, 3–4 mm. long; segments occasionally 4, lanceolate, acuminate, dorsally rounded, membranous, glabrous; the inner much shorter than the outer; ovary elliptic, 2-celled; styles 2, connate from the base throughout nearly half their length; capsule obliquely elliptic, 1-seeded by abortion.

South Africa: Cape Province—Cape Div.: marshy plateau west of Paul's Berg, *Pillans*, 4145, ♀; Wynberg Flats, *Schlechter*, 1686, ♂.—Stellenbosch Div.: seasonal swamps at Stellenbosch, *Duthie*, 167, ♂, 1628*b*, ♀, 1628*d*, ♀.

84. R. Helenae, *Mast. in Journ. Linn. Soc.*, viii, 233 (1865)!; *in DC. Monog. Phan.*, i, 249 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 508 (1895); *Mast. in Fl. Cap.*, vii, 74 (1897): **R. procurrens,** *Mast. in Engl. Bot. Jahrb.*, Beibl. 66, p. 3 (1900)!, pro mult. parte: **R. productus,** *Mast., op. cit.*, p. 5!.

Stems arising sporadically from a creeping rootstock, erect, terete, slender, obscurely wrinkled and puncticulate, moderately or sparingly branched, occasionally simple, 3–7 dm. high; sheaths closely convolute, oblong, rounded at the apex of the coriaceous portion, aristate, mostly 1–1·5 cm. long, with a deciduous, deeply membranous upper margin; male spikelets few or many in lax spicate cymes, cylindric or cylindric-lanceolate, very acute at the apex, straight or somewhat curved, many-flowered, 7–15 mm. long; spathe closely embracing the base of the spikelet, sheath-like but broadly elliptic to orbicular, less than half as long as the spikelet; bracts closely imbricate, rotundate, acute in the thicker portion, mucronate, cartilaginous, scabridous on the exposed parts, 3·5–5 mm. long, with a deciduous, pale-membranous upper margin which rounds off the apex; perianth hidden by its bract, sessile, elliptic, 2·5–3 mm. long; outer segments lanceolate, acute, membranous, the lateral navicular, villous-carinate, the anterior glabrous; inner segments oblong, obtuse, hyaline; female spikelets 1 or 2 in a spicate cyme, resembling the male, several- or many-flowered, 1–2 cm. long; spathe as in the male; bracts closely imbricate, ovate-rotundate, acute in the cartilaginous portion, mucronate, scabridous on exposed parts, pale-membranous at the upper margins, about 5 mm. long; perianth hidden, shortly stipitate, lanceolate, 3·5–4 mm. long; outer segments lanceolate, acute, cartilaginous, the lateral navicular, villous-carinate, the anterior glabrous; inner segments elliptic-lanceolate, membranous, the lateral acute, the posterior obtuse; ovary elliptic, compressed, 2-celled; styles 2, connate at base; capsule 1-seeded by abortion.

South Africa : Cape Province—Caledon Div. : damp spots by Zonder Einde River, *Schlechter*, 9891, ♂ ; hills near Vogel Vley, *Schlechter*, 10496, ♂. —Ceres Div. : Mitchell's Pass, *Bolus*, 9668, ♂.—Worcester Div. : Du Toit's Kloof, *Drège*, 1618, ♀.

85. R. obtusissimus, *Steud., Synops. Pl.*, ii, 252 (1855) ! ; *Mast. in DC. Monog. Phan.*, i, 296 (1878) ; *in Fl. Cap.*, vii, 93 (1897) : **R. digitatus,** var. *β*, *Nees in Linnaea*, v, 638 (1830) ! ; *op. cit.*, vii, 615 (1832) ; *Kunth, Enum.*, iii, 410 (1841), quoad var. *β* ; *Drège in Linnaea*, xx, 241 (1847) ; *Mast. in Journ. Linn. Soc.*, viii, 228 (1865), quoad var. *β*.

Stems erect, terete, rugulose, grey-speckled, simple, 4–9 dm. high, 1·5–2 mm. in diameter at the middle ; sheaths tightly convolute, elliptic-oblong, obtuse, mucronate or stoutly aristate, coriaceous, narrowly membranous at the upper margins, mostly 2–3 cm. long with the mucro or awn ; male spikelets 1–5, adjacent in a spicate cyme, cylindric-oblong, obtuse at both ends, many-flowered, 1–2 cm. long ; spathe embracing the base of the spikelet, ovate or elliptic-ovate, subacute, subulate-mucronate, coriaceous, almost smooth on its outer surface, usually about half as long as the spikelet ; bracts closely imbricate, rotundate or orbicular, deeply concave on the inner side, rounded or obtuse at apex, muticous, coriaceous, very narrowly membranous at the exposed margins, smooth, chestnut-brown, dark-banded round the upper margin, 4–5 mm. long ; perianth hidden by its bract, sessile, elliptic, obtuse at apex, much compressed, 3 mm. long ; segments membranous ; the outer lateral oblong, acute, navicular, carinate, glabrous, with a broad red line up the middle ; the anterior lanceolate-oblong, obtuse, usually with 2 purple streaks on the lower half ; inner segments lanceolate-oblong, obtuse, hyaline ; female spikelets 2–5 in a linear spicate cyme, each spikelet being hidden by its spathe, oblong, acute at both ends, 3–5-flowered, 1–1·5 cm. long ; spathe erect, convolute, sheath-like, 2–3 cm. long ; bracts closely imbricate, convolute with their own sides, orbicular, abruptly acute, mucronulate, coriaceous, cartilaginous at margins, dorsally scabridous, mostly so at the base, minutely pitted, 8–10 mm. long ; perianth hidden, sessile, ovate, much compressed, 7–8 mm. long ; outer segments lanceolate-ovate, acuminate, membranous, glabrous ; the lateral navicular, somewhat recurved at apex, with a deep keel extending beyond the body of the segment ; inner segments broadly ovate, conduplicate, hyaline, distinctly shorter than the outer ; the lateral acute ; the posterior obtuse and toothed at the apex ; ovary rotundate, compressed, 2-celled, red ; styles 2, shortly united at base, glabrous on their lower parts, slender above, 1·5–2 cm. long.

South Africa : without precise locality, *Drège*, 22, ♂.

Cape Province—Paarl Div. : mountains at French Hoek, *Pickstone*, 5, ♂, 34, ♂.—Caledon Div. : mountains at Sir Lowry's Pass, *Burchell*, 8196, ♂ and ♀, *Zeyher*, ♂, *Schlechter*, 7221, ♂ ; Steenbras River, *MacOwan in*

Herb. Austr.-Afr., 1673, ♂ ; Houwhoek, *Burchell*, 8072, ♂.—Tulbagh Div. : near Tulbagh Waterfall, *Bolus*, 7494, ♂.

In Zeyher's herbarium Sprengel has named this species *Willdenowia tristachys*.

Imperfectly Known Species.

86. R. echinatus, *Kunth, Enum.*, iii, 384 (1841) ! ; *Steud., Synops. Pl.*, ii, 250 (1855) ; *Mast. in Journ. Linn. Soc.*, viii, 228 (1865), sub *R. squarrosus* ; *in DC. Monog. Phan.*, i, 236 (1878), sub *R. squarrosus*, quoad pl. masc. ; *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895), sub *R. squarrosus* ; *Mast. in Fl. Cap.*, vii, 71 (1897), sub *R. squarrosus*, quoad pl. masc.

Stems erect, slender or filiform, terete, tubercled, simple or sparingly branched, 3–5 dm. high ; sheaths closely convolute, oblong, acute, aristate, coriaceous, red-brown, yellow-speckled, mostly 1·5–1·8 cm. long, with deciduous, broad, membranous upper margins ; male spikelets 1–6 in spicate or subpanicled cymes, oblong or elliptic, many-flowered, 8–12 mm. long ; spathe bract-like, with the awn scarcely reaching to the summit of the spikelet ; bracts closely imbricate in their lower parts, erect-spreading or spreading in their upper, ovate, acuminate, mucronate, coriaceous, broadly membranous at the margins, scabridous, purple-brown, about 8 mm. long ; perianth with its apex exposed, on a short, stout stipe, elliptic-oblong, 5 mm. long ; outer segments narrowly oblong-lanceolate, acuminate, cartilaginous, membranous at the margins ; the lateral apiculate, shortly villous on the upper half of the carina ; inner segments oblong, obtuse, hyaline-membranous, much shorter than the outer ; pistillode 2-styled.

South Africa : Cape Province—Paarl Div. : mountain above the waterfall in French Hoek Valley, *Stokoe in Bolus Herb.*, 17253, ♂.—Worcester Div. : Du Doit's Kloof, *Drège*, 49 partly, ♂.

Masters united *R. echinatus*, Kunth, with *R. squarrosus*, Poiret, the type of which he probably did not see ; but an examination of this has shown that Kunth's species is quite distinct.

87. R. Sonderianus, *Mast. in Journ. Linn. Soc.*, viii, 252 (1865) ! ; *in DC. Monog. Phan.*, i, 285 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 511 (1895) ; *Mast. in Fl. Cap.*, vii, 89 (1897).

Stems caespitose, erect, filiform, terete, almost smooth and with minute yellowish speckles or very minutely tubercled, simple, 2–3 dm. high ; sheaths closely convolute, often loose at the apex, oblong, acute or acuminate, subulate-mucronate, coriaceous, membranous at the upper margins, pale red-brown, speckled, mostly 1·5–2 cm. long ; male spikelets 1–4, adjacent in a spicate cyme, obovate or elliptic-obovate, many-flowered, 7–10 mm. long ; spathe sheath-like, about half as long as the spikelets ; bracts loosely imbricate ovate-elliptic, tapered at the apex into a short mucro, coriaceous,

with cartilaginous margins, nervose, red-brown, 4–5 mm. long; perianth subsessile, oblong-lanceolate, about 4·5 mm. long; outer segments linear-lanceolate, acute, cartilaginous; the lateral navicular, minutely hispid on the upper half of the carina; inner segments linear-lanceolate, subacute or obtuse, hyaline-membranous, distinctly shorter than the outer; rudimentary ovary trigonous, with 3 lobes, with 3 minute styles.

South Africa: Cape Province—without precise locality, *Marloth*, 11786*a*, ♂.

Worcester Div.: Du Toit's Kloof, *Drège*, 82 partly, ♂.—Clanwilliam Div.: Cedar Berg, *Drège*, 2483, ♂.—Van Rhynsdorp Div.: Groen River and Watervals River, *Drège*, 92, ♂.

There is much affinity with *R. pedicellatus*, the present species being distinguished from the other by its very acute bracts, which character, however, may be a variation in a variable species.

88. R. crinalis, *Mast. in Journ. Linn. Soc.*, viii, 229 (1865)!; *in DC. Monog. Phan.*, i, 239 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 505 (1895); *Mast. in Fl. Cap.*, vii, 72 (1897).

Stems erect, filiform, terete, finely tubercled, much branched from about the middle upwards, 3–5 dm. high; sheaths closely convolute except at the apex, oblong, acuminate, with a slender awn, coriaceous, tubercled, broadly pale-membranous at the upper margins, mostly 1–1·5 cm. long, without the awn, on the main stems; male spikelets 1–2 in a spicate cyme, elliptic-oblong, several- or many-flowered, 5–8 mm. long; spathe sheath-like but smaller, with the hair-like awn much overtopping the spikelet; bracts erect-spreading and loosely embracing the flowers, ovate-lanceolate, acute, mucronate, chartaceous, pale red-brown, pale-membranous at the margins, 3–4 mm. long; perianth with its sides much exposed, shortly stipitate, elliptic-oblong, 2·5–2·75 mm. long; outer segments oblong-lanceolate, acute, cartilaginous; the lateral navicular, glabrous; inner segments elliptic, obtuse, submembranous; pistillode 2-styled.

South Africa: Cape Province—Worcester Div.: Du Toit's Kloof, *Drège*, 11, ♂.

The presence of a 2-styled pistillode indicates the probability of this plant being the male of some Hypolaena.

89. R. oblongus, *Mast. in Journ. Linn. Soc.*, viii, 229 (1865)!; *in DC. Monog. Phan.*, i, 239 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 71 (1897).

Stems somewhat decumbent at base, thence erect or erect-spreading, very slender, terete, wrinkled and white-speckled, more or less tubercled on the lower parts, much branched, 3–7 dm. high; sheaths closely convolute except in their upper parts, oblong, acute or with the membranous apex obtuse, with a slender awn, coriaceous, yellow-speckled, pale-mem-

branous at the upper margins, with a purple band along the base of the membranous portion, without the awn mostly 1·5–2·5 cm. long on the main stems; male spikelets 1–3 in a spicate cyme, obovate or elliptic, several- or many-flowered, 5–10 mm. long; spathe sheath-like but smaller, with the awn overtopping the spikelet; bracts loosely imbricate, oblong-ovate, acute, mucronate, cartilaginous, red-brown pale-membranous at the margins, 4–5 mm. long; perianth slightly exposed at the sides, shortly stipitate, elliptic-oblong, subtrigonous, 2·75–3 mm. long; segments acute, cartilaginous, pale red-brown; the outer lateral oblong, navicular, glabrous; the anterior elliptic; inner segments elliptic, with membranous, involute margins, equalling or shortly exceeding the outer; pistillode 2-styled.

South Africa : without precise locality, *Drège*, 65, ♂.

The presence of a 2-styled pistillode indicates the probability of this plant being the male of some species of Hypolaena.

Restio squamosus, *Thunb. in Hoffm. Phytog. Blätt.*, i, 8 (1803)!; *in Weber et Mohr, Archiv*, i, 26 (1804); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. 1, 332 (1811); ed. *Schultes*, 87 (1823); *Spreng., Syst. Veg.*, i, 187 (1825); *Kunth, Enum.*, iii, 414 (1841); *Steud., Synops. Pl.*, ii, 254 (1855); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 418 (1875); *Mast. in Fl. Cap.*, vii, 98 (1897). An examination of the type of this species in Thunberg's herbarium shows it to be a Thesium, possibly *T. Schumannianum*, Schltr.

II, CHONDROPETALUM, *Rottb., Program.*, 12 (1772); *ejusd. Descr. et Icon.*, 10, tab. 3, fig. 2 (1773); *Kunth, Enum.*, iii, 460, adnot. (1841): **Dovea,** *Kunth., op. cit.*, 457; *Meisner, Gen. Pl.*, 408 (1842); *Endl., Gen. Pl. Suppl.*, 2, p. 11 (1842); *Steud., Synops. Pl.*, ii, 248 (1855); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 413 (1868); *Mast. in Journ. Linn. Soc.*, x, 248 (1868); *in DC. Monog. Phan.*, i, 305, tab. ii, figs. 1–6, tab. v, fig. 6 (1878); *Benth. et Hook., Gen. Pl.*, iii, 1031 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 8 (1888); *Mast. in Fl. Cap.*, vii, 99 (1897): **Askidiosperma,** *Steud., Synops. Pl.*, ii, 257; *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 413; *Mast. in DC. Monog. Phan.*, i, 304, tab. i, figs. 32–36; *Benth. et Hook., Gen. Pl.*, iii, 1032; *Hieron., loc. cit.*; *Mast. in Fl. Cap.*, vii, 98.

Flowers dioecious. Male spikelets many in panicled cymes, oblong, ovate or orbicular, few- or many-flowered, usually somewhat compressed, with few or no empty bracts. Perianth more or less trigonous or compressed, often somewhat arcuate, usually much longer than the bract; segments 6, in 2 series, the outer lateral navicular, mostly carinate, glabrous or villous on the carina, the inner oblong or lanceolate, rounded on the outer side, distinctly longer than the outer. Anthers ovate-oblong, conspicuously

apiculate. Rudimentary ovary with 2 or 3 minute styles. Female spikelets usually resembling the male, generally in a shorter and more crowded inflorescence and with fewer flowers. Perianth trigonous or occasionally compressed; segments 6, resembling those of the male, the inner usually much longer than the outer, occasionally equal, in one species the outer exceed the inner. Staminodes strap-shaped. Ovary trigonous, 3-lobed and 3-celled or compressed and by abortion 2-celled. Styles 2 or 3, free. Fruit capsular, trigonous, 3-lobed and 3-seeded or compressed and by abortion 2- or 1-seeded. Seeds smooth or ribbed.

Flowering stems tufted or on a creeping rootstock, erect, simple, or branched, terete, clothed at base with crowded, dark-coloured sheaths; upper sheaths deciduous or persistent. Barren stems seldom present. Female inflorescence often with persistent or subpersistent, conspicuous spathes.

The genus is endemic.

Key based on Characters in the Female Plants.

Styles 2:
- Stems simple; bracts acuminate, aristate . . . . . (16) *capitatum.*
- Stems branched; bracts acute, mucronulate . . . . . (5) *microcarpum.*

Styles 3:
- Stems branched . . . . . (8) *macrocarpum.*
- Stems simple:
  - Inner perianth-segments shorter than the outer:
    - Spikelets 1-flowered . . . . . (12) *paniculatum.*
    - Spikelets containing more than 1 flower . . . . . (14) *chartaceum.*
  - Inner and outer perianth-segments equal in length . . . . (4) *rectum.*
  - Inner perianth-segments very slightly longer or shorter than the outer in the same inflorescence or perianth-segments equal in length . . (13) *Andreaeanum.*
  - Inner perianth-segments longer than the outer:
    - Bracts linear-lanceolate, acuminate, aristate . . . . (15) *nitidum.*
    - Bracts not as above:
      - Spathes light brown, 5–10 cm. long . . . . (11) *mucronatum.*
      - Spathes chestnut-brown, shorter:
        - Perianth 4–5 mm. long:
          - Spikelets 1- or 2-flowered . . . . . (7) *ebracteatum.*
          - Spikelets 2- or 3-flowered:
            - Spathes about 2·5 cm. long; spikelets 4–5 mm. long . (10) *aggregatum.*
            - Spathes about 1 cm. long; spikelets 6–7 mm. long . (9) *Marlothii.*
        - Perianth less than 4 mm. long:
          - Spathes persisting throughout the flowering period:
            - Leaf-sheaths persistent . . . . . (1) *deustum.*
            - Leaf-sheaths deciduous . . . . . (6) *Hookerianum.*
          - Spathes falling before or during the opening of the flowers:
            - Inner perianth-segments scabrid over the entire outer surface, and having a prominent median nerve from base to apex . . (2) *nudum.*
            - Inner perianth-segments somewhat scabrid on the upper parts of the outer surface, without a prominent median nerve . (3) *tectorum.*

1. C. deustum, *Rottb., Program.*, 12 (1772); *ejusd. Descr. et Icon.*, 10, t. 3, fig. 2 (1773); *Linn. Herb. ex Mast. in Journ. Linn. Soc.*, xxi, 590 (1885)!: **Restio tectorum,** *Steud. in Flora*, 1829, i, 132!, non *L. nec Thunb.*: **R. Chondropetalum,** *Nees in Linnaea*, v, 652 (1830)!, excl. syn. *R. tectorum, L.*; *Nees, op. cit.*, vii, 617 (1832), excl. syn. *R. tectorum, Thunb.*: **Elegia deusta,** *Kunth, Enum.*, iii, 460 (1841), excl. syn. mult.; *Steud., Synops.*, ii, 261, (1855), excl. syn. *R. tectorum*; *Mast. in Journ. Linn. Soc.*, x, 239 (1868), excl. syn. *R. tectorum, Thunb.*; *in DC. Monog. Phan.*, i, 352 (1878); *in Journ. Linn. Soc.*, xxi, 590, Nos. 13, 14 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 111 (1897).

Stems caespitose, erect, simple, slender and wiry, finely wrinkled, reflecting a golden iridescence, 2·5–6 dm. high, 0·75–1 mm. in diameter at base; sheaths mostly basal, a solitary one on the upper half of the stem, persistent, linear-oblong, widely rounded at apex, aristate, coriaceous, thinner at the margins, smooth or nervose, light or medium brown, 2–5 cm. long; male inflorescence paniculate-cymose, linear-oblong, usually interrupted, 3–6 cm. long; spathes persisting during the flowering period, erect-spreading, expanded or with the sides involute, lanceolate, obtuse, mucronate, cartilaginous, striate, red-brown, 1–3 cm. long; spikelets crowded, ovate, 5–8-flowered, about 4 mm. long; bracts closely convolute, broadly ovate, coriaceous, dorsally rugulose, chestnut-brown, half as long as the perianth; empty bracts solitary or absent; perianth sessile, more or less arcuate, oblong, slightly compressed, 2·5 mm. long; outer segments lanceolate, acute, mucronulate, cartilaginous, scabridous, dark brown; the lateral navicular, carinate; inner segments lanceolate, mucronulate, dorsally rounded, nearly smooth, light brown, twice as long as the outer; female inflorescence resembling the male but narrower; spathes as in the male; spikelets 2- or 3-flowered, rounded, about 3 mm. long; bracts as in the male; perianth sessile, trigonous, ovate, 2·5 mm. long; outer segments as in the male; inner segments ovate-oblong, slightly exceeding to nearly twice as long as the outer; ovary trigonous, 3-celled; styles 3, short; fruit 3-lobed, by abortion 1-seeded.

South Africa : without precise locality, *Berg*, ♂, *Sieber*, 226, ♂.

Cape Province—Cape Div.: Table Mt., *Burchell*, 565, ♂ and ♀, *Drège*, 123, ♀, *Ecklon*, 839, ♂, *Bolus*, 4444, ♂, *Reichenbach*, ♂, *Rehmann*, 631, ♂, 632, ♂, 635, ♂, *Marloth*, 3137, ♀, *Pillans*, 3402, ♂ and ♀, 4298, ♂ and ♀; Devil's Peak, *R. Brown*, ♂.—Caledon Div.: Houwhoek, *Burchell*, 8114, ♂ and ♀; Zwartberg, above Caledon, *Schlechter*, 10373, ♂.

2. C. nudum, *Rottb., Program.*, 12 (1772); *ejusd. Descr. et Icon.*, p. 11, t. 3, fig. 3 (1773): **Restio nudus,** *Nees in Linnaea*, v, 651 (1830)!, partim: **Elegia sp.,** *Endlich, Gen.*, 122 (1836): **E. nuda,** *Kunth, Enum.*, iii, 462 (1841)!; *Steud., Synops.*, ii, 261 (1855); *Mast. in Journ. Linn. Soc.*, x,

239 (1868), excl. syn. *R. acuminatus, Thunb.*; *in DC. Monog. Phan.*, i, 353 (1878), partim; *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 114 (1897): **Dovea nuda,** *Pillans in Ann. Bolus Herb.*, iii, 146 (1922).

Stems usually caespitose, occasionally arising sporadically from creeping rhizomes, erect, simple, slender and wiry, 3–8·5 dm. high, 1–1·5 mm. in diameter throughout the greater part of their length; sheaths caducous, oblong, acute, subulate-mucronate, coriaceous, thinner at the apex, smooth and shiny, chestnut-brown, 1·3–2 cm. long; male inflorescence paniculate-cymose, linear-oblong, usually interrupted in its lower parts, 5–7 cm. long, occasionally up to 10 cm. long; spathes caducous, sheath-like but smaller; spikelets crowded on simple, usually solitary rhachillae, ovate or rounded, 5–7-flowered, chestnut-brown, 2–2·5 mm. long; bracts closely convolute, ovate, obtuse, mucronulate, with a prominent median nerve, cartilaginous, thinner at the margins, about 1·5 mm. long; empty bracts about 2, smaller; perianth sessile, oblong, acute, somewhat curved in the upper part, 1·5 mm. long; outer segments lanceolate, acute, thin, glabrous, $\frac{2}{3}$ of the length of the inner; the lateral slightly carinate; inner segments ovate-oblong, acute, dorsally rounded, with involute margins, cartilaginous; female inflorescence paniculate-cymose, broader, shorter and denser than in the male; spathes caducous, as in the male; spikelets rounded or broader than long, 3–4-flowered, about 2·5 mm. long; bracts ovate, acute, slightly keeled on the upper half, cartilaginous, 1·5 mm. long; perianth as in the male but 2·25 mm. long; segments as in the male but the inner entirely scabrid on the outer surface and with a prominent median nerve extending from base to apex; ovary ovate, 2-celled by abortion; styles 3, slender; fruit 2- or, often, by abortion, 1-seeded.

South Africa: without precise locality, *Sieber*, 111, ♀, *Boivin*, 499, ♂, *Verreaux*, ♀.

Cape Province—Cape Div.: Cape Flats, *Alexander*, ♀, *Burke*, ♂, *Wilms*, 3802, ♂, 3804, ♀, *Buchanan*, 162, ♂, *Pappe in Herb. Mus. Austr.-Afr.*, 12986, ♂ and ♀, *MacOwan*, 1674 partly, ♂, 3072, ♂, *Rehmann*, 1804, ♂, *Schlechter*, 7541, ♂, *Wolley-Dod*, 2601, ♀, 2602, ♂, *Marloth*, 3131, ♂, *Page in Bolus Herb.*, 16902, ♂ and ♀, *Pillans*, 3131, ♂ and ♀; between Wynberg and Devil's Peak, *Drège*, 147*a*, ♂; flats between Retreat and Steenberg, *Pillans*, 2959, ♂, 2960, ♀; Schoester's Kraal, *Wolley-Dod*, 3292, ♀.—Malmesbury Div.: Hopefield, *Bachmann*, 1852, ♂.—Caledon Div.: between Ganze Kraal and Genadendal, *Burchell*, 7568, ♂.—Paarl Div.: between Paarl and Lady Grey Bridge, *Drège*, 9454, ♂ and ♀.—Worcester Div.: Goudini, *Drège*, 147*b*, ♂.

3. C. tectorum, *Pillans*, comb. nov.: **Restio tectorum,** *Linn. fil., Suppl. Plantarum*, 425 (1781)!; *Linn., Syst. Veg.*, ed. 14, p. 882 (1784); *Thunb., Diss.*, 13 (1788); *in Usteri, Delect*, i, 47 (1790); *ejusd. Prodr.*, 15 (1794);

Linn., Syst. Veg., ed. 15, p. 925 (1797); *Poir. in Lam., Encycl. Meth.*, vi, 175 (1804), excl. syn. *Chondropetalum deustum, Rottb.*; *Willd., Sp. Pl.*, iv, pars 2 p. 721 (1806), excl. syn. *Rottb.*; *Pers., Syn. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 323 (1811); *Aiton, Hort. Kew.*, v, 638 (1813), excl. syn. *Rottb.*; *Thunb., Fl. Cap.*, ed. *Schultes*, 85 (1823), excl. syn. *Rottb.*; *Spreng., Syst. Veg.*, i, 184 (1825), excl. syn.; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 417, Nos. 12 and 13 (1875); *Linn. Herb. ex Mast. in op. cit.*, xxi, 590 (1885): **R. nudus,** vars. *α et β, Nees in Linnaea*, v, 651 (1830) !, excl. syn.: **Elegia racemosa,** *Kunth, Enum.*, iii, 463 (1841) !, quoad pl. fem., excl. syn. omn.; *Steud., Synops.*, ii, 261 (1855), quoad pl. fem., non *Persoon*: **Dovea tectorum,** *Mast. in Journ. Linn. Soc.*, x, 249 (1868) !; *in DC. Monog. Phan.*, i, 306 (1878), excl. syn. *Restio racemosus, Lam. et Elegia racemosa, Pers.*; *in Journ. Linn. Soc.*, xxi, 590, Nos. 13, 15, 16 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 99 (1897), excl. syn. *Elegia* : **D. cylindrostachya,** *Mast. in Fl. Cap.*, 100 !.

Stems caespitose, erect, simple, wiry or rather stout, smooth, 9–15 dm. high, 1·5–4 mm. in diameter; sheaths caducous, lanceolate-oblong, acute, mucronate, coriaceous, smooth, chestnut-brown, membranous and nervose at the paler apex, 2·5–4 cm. long; male inflorescence paniculate-cymose, linear to oblong, narrowed in the upper parts, dense and compact or interrupted, 0·3–3·5 dm. long; spathes sheath-like, caducous; rhachillae erect, variously branched; spikelets ovate or rounded, 4–10-flowered, chestnut-brown, 3–4 mm. long; spathellae inconspicuous; bracts closely convolute, broadly ovate, rounded at apex, obtusely carinate, coriaceous, brown-membranous at the margins, 1·5–1·75 mm. long; empty bracts 2 or 3, smaller; perianth sessile, ovate in its lower part, tapered from its middle to the obtuse apex, 1·75–2·5 mm. long; outer segments oblong-ovate, obtuse or subacute, cartilaginous; the lateral navicular, villous-carinate; the anterior dorsally rounded, glabrous; inner segments oblong-lanceolate, acute, with slightly involute margins, cartilaginous, twice as long as the outer; female inflorescence resembling the male but usually more compact and shorter; spathes as in the male, caducous; spikelets broadly ovate, somewhat compressed, 2–4-flowered, chestnut-brown, 3–3·5 mm. long; sterile bracts 1 or 2, smaller than the fertile; fertile bracts as in the male; perianth shortly stipitate, ovate to oblong, obtuse, in its upper parts protruding beyond the bract, 1·5–2·5 mm. long; segments ovate-lanceolate or oblong-lanceolate, acute, cartilaginous; the outer-lateral carinate, glabrous or slightly villous on the carina; the anterior dorsally rounded, glabrous, often longer than the lateral; inner segments exceeding the outer by a third to one half of their length; the lateral dorsally rounded; the posterior flattened; ovary oblong, 3-celled; styles 3, distinct.

South Africa : without precise locality, *Thunberg*, ♂, *Banks*, ♂, *Wallich*, ♂ and ♀, *Thom*, 908, ♀.

Cape Province—Cape Div. : " False Bay," *Robertson*, ♀, *Admiral Sir F. Grey*, ♂ ; Wynberg, *Wallich*, ♀ ; Cape Flats, *Burchell*, 824, ♂, 828, *Burke*, ♂, *Ecklon*, 559, ♂, *Pappe in Herb. Mus. Austr.-Afr.*, 12980, ♀, *O. Kuntze*, ♂, *MacOwan*, 1674 partly, ♂ and ♀, *Marloth*, 3132, ♂, *Pillans*, 3905, ♂ and ♀, 4389, ♂ and ♀, *Page in Bolus Herb.*, 14333, ♂ and ♀ ; Raapenburg, *Guthrie*, 790, ♂ ; Uitvlugt, *Pillans*, 4383, ♂ and ♀.—Malmesbury Div. : Hopefield, *Bolus*, 12902, ♂, 12903, ♂, *Bachmann*, 1847, ♂, *Marloth*, 3662, ♂ ; Groene Kloof, *Pappe in Herb. Mus. Austr.-Afr.*, 12979, ♀ ; Darling, *Marloth*, 3663, ♀, *Schlechter*, 5335, ♂.—Clanwilliam Div. : Jackhals River, *Drège*, 2506, ♂ and ♀ ; Zuurfontein, *Schlechter*, 8557, ♂, 8558, ♀.—Stellenbosch Div. : Sir Lowry's Pass, *O. Kuntze*, ♂.—Caledon Div. : Houwhoek, *Burchell*, 8127, ♂ and ♀, *Drège*, 9605, ♀ ; hills near Vogelgat, *Schlechter*, 10423 ♀.—Riversdale Div. : Albertinia, *Rogers*, 4109, ♀.—Port Elizabeth Div. : Port Elizabeth, *E. S. C. A. Herb.*, 288, ♀ ; Earn Cliff, *Galpin*, 6389, ♀, Red House, *Paterson*, 337, ♀.—Albany Div. : Port Alfred, *Burchell*, 3996 partly, ♀.

4. C. rectum, *Pillans*, comb. nov. : **Dovea recta,** *Mast. in Fl. Cap.*, vii, 101 (1897) !.

Stems erect from creeping rhizomes, simple, slender, terete, 3–4 dm. high, 1 mm. in diameter in the lower half ; sheaths caducous, oblong, obtuse, mucronate, coriaceous, nervose, 8–10 mm. long ; male inflorescence laxly paniculate-cymose, usually 7–10 cm. long, occasionally 20 cm. long ; spathes sheath-like but thinner, caducous ; lower branches of the inflorescence 1·5–6 cm. long ; spikelets narrow-ovate, acute, often slightly curved, 3–4-flowered, 2·5–3 mm. long ; bracts oblong-ovate or ovate, obtuse mucronulate, chartaceous, 1–1·75 mm. long ; empty bracts solitary ; perianth slightly curved, oblong-lanceolate, acute, about 2 mm. long ; outer segments linear-lanceolate, acute, somewhat keeled, glabrous, membranous ; the inner linear-lanceolate, acute, dorsally rounded, membranous, about twice as long as the outer ; female inflorescence narrowly paniculate-cymose, 4–6 cm. long ; spathes as in the male but smaller ; branches of the inflorescence mostly 0·5–2 cm. long ; spikelets oblong, obtuse, 2–3-flowered, 3–3·5 mm. long ; bracts ovate-oblong, obtuse, mucronulate, 2–2·5 mm. long ; empty bracts 2 or 3 ; perianth oblong, obtuse, 2·25 mm. long ; outer-lateral segments ovate-oblong, acute, slightly keeled ; the anterior lanceolate-oblong, acute ; inner segments ovate-oblong, acute, equalling the outer ; ovary 2-celled, obovate ; styles 3, separated ; fruit 1–2-seeded.

South Africa: Cape Province—Cape Div. : Cape Flats, near Claremont, *Schlechter*, 427, ♂ ; Kenilworth Racecourse, *Wolley-Dod*, 2430, ♀, *Page in Bolus Herb.*, 14334, ♂ and ♀, *Pillans*, 3400, ♂ and ♀ ; flats 4 miles east of

Mowbray, *Pillans*, 2961, ♂, 2962, ♀.—CALEDON DIV.: between Donkerhoek and Houwhoek Mts., *Burchell*, 8007, ♂.—MALMESBURY DIV.: Theefontein, *Bachmann*, 1771, ♀, 1772, ♀.

5. C. microcarpum, *Pillans*, comb. nov.: **Dovea microcarpa,** *Kunth, Enum.*, iii, 459 (1841)!; *Steud., Synops.*, ii, 248 (1855); *Mast. in Journ. Linn. Soc.*, x, 248 (1868): **D. rigens,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 7 (1900)!.

Stems arising sporadically from black, scaly rhizomes, erect, much branched from near the base upwards, terete, smooth, 1–4·5 dm. high, about 2 mm. in diameter at the base; sheaths mostly persisting during the flowering period, stem-clasping at base, with their upper parts erect-spreading and more or less flattened, with margins slightly involute, lanceolate-oblong, acute, aristate, chartaceous, light brown, mostly 0·5–1 cm. long, up to 1·5 cm. long; male inflorescence a linear, loose, spiciform panicle, usually 1–3 cm. long, occasionally oblong and dense and not exceeding 0·5 cm. in length; spathes sheath-like but smaller; spikelets broadly ovate, 3–7-flowered, 2 mm. long; bracts closely convolute, ovate, acute, mucronulate, coriaceous, faintly transverse-rugose, chestnut-brown, 1·5 mm. long; perianth sessile, oblong, acute at apex, 1·5 mm. long.; segments cartilaginous; the outer ovate, acute; the lateral slightly carinate; inner segments oblong-lanceolate, acute, dorsally rounded, twice as long as the outer; female inflorescence a spiciform panicle, shorter than that of the male and with the branches often very short; spathes as in the male; spikelets 1-flowered, ovate, 2–2·5 mm. long; bracts solitary in each spikelet, closely convolute, ovate, acute, mucronulate, membranous, reddish, about 2 mm. long; perianth sessile, obovate, 2 mm. long; outer segments oblong-lanceolate to ovate, acute, mucronulate, membranous, reddish; the lateral carinate; inner segments ovate, acute, mucronulate, dorsally rounded, cartilaginous, chestnut-brown, exceeding the outer by about one-third of their length; the lateral slightly carinate at apex; ovary 2-celled, obovate; styles 2, separated, divergent; fruit 2- or, by abortion, 1-seeded.

South Africa: Cape Province—CAPE DIV.: Cape Flats, *Pappe in Herb. Mus. Austr.-Afr.*, 12834, ♂, *Rehmann*, 1010, ♂, *Pillans*, 2957, ♂, 2958, ♀; Zeekoe Vley, *Zeyher*, ♀; Zand Vley, *Edwards in Bolus Herb.*, 15678, ♀.—BREDASDORP DIV.: Mierkraal, *Schlechter*, 10502, ♂, 10503, ♀.—SWELLENDAM DIV.: Sebastian Bay, *Garnot*, ♀.—RIVERSDALE DIV.: Milkwoodfontein, *Galpin*, 4787, ♂ and ♀; Still Bay, *Muir in Galpin Herb.*, 5404, ♂, *Muir*, 3101, ♂; Melkhoutfontein, *Muir*, 3104, ♂ and ♀, 3109*a*, ♂ and ♀; Vermakkelijheid, *Muir*, 2527, ♂.—HUMANSDORP DIV.: Slang River, *Fourcade*, 1812, ♂.—UITENHAGE DIV.: Van Staden's, *Schlechter*, 6067, ♀.—PORT ELIZABETH DIV.: Emerald Hill, *Bolus*, 9806, ♂ and ♀; Humewood, *Paterson*, 618, ♀, 2546, ♀, 3347, ♀.

6. C. Hookerianum, *Pillans*, comb. nov.: **Elegia nuda,** var. *α, racemo elongato, Nees ex Drège in Linnaea*, xx, 242 (1847)!, absque descript., excl. syn. *E. racemosa, Pers.*: **Dovea Hookeriana,** *Mast. in Journ. Linn. Soc.*, x, 249 (1868)!; *in DC. Monog. Phan.*, 1, 306 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895); *Mast. in Fl. Cap.*, vii, 100 (1897): **Restio tectorum,** *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 417, No. 14 (1875)!: **D. Bolusii,** *Mast. in Journ. Linn. Soc.*, xxi, 576 (1885)!; *Durand et Schinz, loc. cit.*; *Mast. in Fl. Cap.*, vii, 102: **R. ambiguus,** *Mast., op. cit.*, 96!.

Stems caespitose, erect, simple, wiry, faintly wrinkled and puncticulate, 3·5–6 dm. high; sheaths caducous, elliptic, acute, mucronate, coriaceous, chestnut-brown, 1–2 cm. long; male inflorescence paniculate-cymose, linear-oblong, rather dense, 3–10 cm. long; spathes sheath-like but smaller and somewhat flattened tardily deciduous; spikelets approximate, ovate, slightly compressed, 2–4-flowered, chestnut-brown, 3–4 mm. long; bracts closely convolute, ovate, acute, mucronulate, often carinate, about 2 mm. long; empty bracts 1 or 2; perianth sessile, straight, or the side ones curved, linear-oblong, narrowed at the apex, 3 mm. long; outer segments lanceolate, acuminate, mucronulate, cartilaginous, about 2 mm. long; the lateral carinate, minutely villous on the carina; inner segments lanceolate, acute, dorsally rounded, cartilaginous, paler and much longer than the outer; female inflorescence resembling the male but with fewer and shorter rhachillae, 3–10 cm. long; spathes as in the male; spikelets 1–3-flowered, somewhat compressed or trigonous, 4–5 mm. long; bracts closely convolute, ovate, obtuse or subacute, mucronate, about 3 mm. long; perianth ovate, trigonous, 3–3·5 mm. long; outer segments oblong, acute, mucronulate, cartilaginous; the lateral carinate; inner segments ovate-oblong, acute, cartilaginous, slightly exceeding the outer in length; ovary 3-lobed, 3-celled; styles 3; fruit 3-seeded; seeds elliptic, with a median ridge on the dorsal and ventral sides, purple-brown, with white wavy lines from end to end.

South Africa: without precise locality, *Thunberg*, ♂, *Thom*, 632, ♀, 901, ♂, 1621, ♂.

Cape Province—Cape Div.: on the Muizenberg, *Bolus*, 3909, ♀, 3910, ♂, *Moss*, 7844, ♂, 7855, ♀; hills west of Simon's Town, *Pillans*, 3411, ♂ and ♀. —Stellenbosch Div.: mountains above Stellenbosch, *Garside*, 1213, ♂. —Caledon Div.: Hottentots Holland Mts. at Sir Lowry's Pass, *Schlechter*, 7257, ♀, *Guthrie in Bolus Herb.*, 16621, ♀; Houwhoek, *Burchell*, 8062, ♀, *Schlechter*, 7400, ♀, 7575, ♂, 7576, ♀; Zwartberg, at Caledon, *Pappe in Herb. Mus. Austr.-Afr.*, 12844, ♀, 12845, ♀, *Schlechter*, 5587, ♀; Hemel en Aarde, *Zeyher*, 4335, ♀; Babylons Tower, *Guthrie in Bolus Herb.*, 16184, ♀; Zwartberg, near Sandfontein, *Schlechter*, 10341, ♂, 10342, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 124 partly, ♂.

7. C. ebracteatum, *Pillans*, comb. nov.: **Dovea ebracteata,** *Kunth, Enum.*, iii, 458 (1841)!; *Drège, Zwei Pfl. Documente*, 82 (1844); *Steud., Synops.*, ii, 248 (1855); *Mast. in Journ. Linn. Soc.*, x, 249 (1868); *in DC. Monog. Phan.*, i, 308 (1878), excl. syn. *D. microcarpa*; *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895), excl. syn. *D. microcarpa, Kunth*; *Mast. in Fl. Cap.*, vii, 102 (1897), excl. syn. *D. microcarpa*: **Elegia racemosa,** *Kunth, Enum.*, iii, 463!, non *Thunb.*, quoad pl. masc., excl. syn. omn.

Stems caespitose, erect, simple, wiry, smooth, 3–9 dm. high, scarcely 2 mm. in diameter at their broadest parts; sheaths mostly persisting during the flowering period, linear-oblong, obtuse or subacute, with a short, slender awn, coriaceous, smooth, shiny, chestnut-brown, thinner and paler at the margins, mostly 3–5 cm. long; male inflorescence paniculate-cymose, narrow-oblong, dense, 3–4 cm. long; spathes deciduous, sheath-like but smaller, flattened, the lower usually about 2·5 cm. long; spikelets crowded on short branches, oblong, 2-sided, 2-flowered, 3–3·5 mm. long; bracts closely convolute, broadly ovate, obtuse, membranous, brown, 1·5–2 mm. long; empty bracts 1 or 2; perianth sessile, protruding partly beyond the bract, acorn-shaped, straight or rarely slightly curved, trigonous, obtuse at apex, 3 mm. long; outer segments oblong, obtuse or subacute, cartilaginous, glabrous, half as long as the inner; the lateral obtusely carinate; inner segments linear-oblong, obtuse, dorsally rounded, cartilaginous, paler than the outer; female inflorescence resembling the male but with fewer flowers; spathes persistent, often slightly larger than in the male; spikelets 1–2-flowered, 4–5 mm. long; bracts closely convolute, ovate-oblong, acute, mucronate, cartilaginous, about 4 mm. long; perianth sessile, oblong, obtuse, obscurely trigonous, 4–5 mm. long; outer segments oblong, acute, coriaceous, nearly as long as the inner; the lateral slightly angular on the dorsal surface; inner segments oblong, acute, cartilaginous, dorsally rounded; ovary trigonous, obovate, 3-celled; styles 3, stout; fruit 3-seeded.

South Africa: without precise locality, *Sieber*, 232, ♀, *MacGilliveray*, 438, ♂.

Cape Province—Cape Div.: Table Mt., *Burchell*, 524, ♂ and ♀, 526, ♀, 567, ♂ and ♀, *Milne*, 236, ♂, *Bolus*, 4445, ♂ and ♀, *R. Fries*, ♂, *Wolley-Dod*, 2148, ♀, *Galpin*, 4809, ♂ and ♀, *Marloth*, 3101, ♂, 3123, ♀, *Moss*, 7861, ♂ and ♀, *Pillans*, 4390, ♂ and ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 124 partly, ♂ and ♀, 125 partly, ♀, 1637, ♀.—Riversdale Div.: Garcia's Pass, *Bolus*, 11398, ♀; Mozambique Kop, *Muir*, 3216, ♂, 3217, ♀.

8. C. macrocarpum, *Pillans*, comb. nov.: **Dovea macrocarpa,** *Kunth, Enum.*, iii, 458 (1841)!; *Drège, Zwei Pfl. Documente*, 76, 110, *bis* (1844); *Steud., Synops.*, ii, 248 (1855); *Mast. in Journ. Linn. Soc.*, x, 250 (1868), excl. syn. mult.; *in DC. Monog. Phan.*, i, 307 (1878), excl. syn. mult.; *Durand*

et Schinz, Consp. Fl. Afr., v, 513 (1895), excl. syn. omn.; *Mast. in Fl. Cap.*, vii, 101 (1897), excl. syn. *R. nudus*: [**Elegia macrocarpa,** *Nees ex Drège in Linnaea*, xx, 242 (1847), nomen].

Stems erect, sparingly branched from about the middle upwards, stout and rigid in their lower parts, slender and somewhat flexuous in their upper, terete, minutely wrinkled and puncticulate, about 1 m. high, 3 mm. in diameter at middle; branches erect, simple, compressed at base, terete above, with a very short basal internode; sheaths caducous, oblong, acute, mucronate, coriaceous, thinner at the margins, red-brown, minutely pitted and yellow-speckled on the outer surface, 2–3 cm. long, smaller on the branches; male inflorescence paniculate-cymose, narrow, 5–15 cm. long; branches 1–3 at each node, 2–4 cm. long, bearing many short branchlets; spathes caducous, sheath-like but smaller; spikelets 4–6-flowered, broadly ovate, obtuse or rounded at apex, blackish, 3–4 mm. long; bracts rounded or broader than long, muticous, subcoriaceous, membranous at the margins, 1·5 mm. long; empty bracts about 3, larger; perianth sessile, oblong, obtuse, 2 mm. long; outer segments subcoriaceous, membranous at the margins, half as long as the inner; the lateral navicular, oblong, acute, carinate, minutely villous on the carina; the anterior oblong, obtuse, dorsally rounded, glabrous; inner segments oblong, obtuse, cartilaginous; female inflorescence spicate-cymose, 3–10 cm. long; spathes persistent, resembling the upper sheaths, 1·5–2 cm. long; spikelets sessile, ovate, becoming orbicular with the development of fruit, 1-flowered, 1–1·5 cm. long; empty bracts about 7, the lowermost spathe-like, the others ovate to suborbicular, mucronulate, coriaceous, nervose-striate, chestnut-brown, 6–7 mm. long; fertile bract not differing from the empty immediately below; perianth sessile, partly protruding beyond the bracts, trigonous, ovate, about 7 mm. long; segments rigidly cartilaginous; the outer ovate, obtuse, muticous, dorsally rounded, shorter than the inner; inner segments orbicular, mucronate, distinctly larger than the outer; ovary ovate; styles 3, stout, nude at base; fruit protruding much beyond the bracts, 1–3-seeded, orbicular; seeds oval with a ribbed testa.

South Africa: Cape Province—Piquetberg Div.: Piquetberg, *Drège*, 2507, ♂; between Pretoris and Piqueniers Kloof, *Drège*, 2523, ♀.—Clanwilliam Div.: between Lang Vley and Berg Vley, *Zeyher*, 1740, ♂ and ♀; between Piqueniers Kloof and Olifants River, *Dickson in Bolus Herb.*, 4243, ♀; Piqueniers Kloof, *Schlechter*, 7947, ♂, 7948, ♀; Warm Baths, in Olifants River Valley, *Edwards in Bolus Herb.*, 14414, ♂.

9. C. Marlothii, *Pillans*, comb. nov.: **Dovea Marlothii,** *Pillans in Ann. Bolus Herb.*, iii, 143 (1922).

Stems caespitose, erect, simple, stout, finely wrinkled, 6–7 dm. high, 2–2·75 mm. in diameter at the middle; sheaths caducous, oblong, acute,

mucronate, coriaceous, striate, chestnut-brown, 2·5–3·5 cm. long; male inflorescence paniculate-cymose, oblong, densely many-flowered, 3–8 cm. long; spathes subpersistent, oblong, acute, mucronate, coriaceous, smooth, chestnut-brown, about 1 cm. long; spathellae inconspicuous, ovate; spikelets ovate, compressed, 2–5-flowered, chestnut-brown, 4–6 mm. long; bracts closely convolute, broadly ovate, acute, cartilaginous, minutely cell-pitted on the upper parts, 3 mm. long; empty bracts 3 or 4, ovate, smaller; perianth sessile, oblong, rounded on the dorsal surface and flattened on the ventral, 3·5–4·5 mm. long; outer segments ovate, subacute, cartilaginous; the lateral slightly carinate; inner segments oblong, obtuse, coriaceous, twice as long as the outer; female inflorescence resembling the male, usually 3–6 cm. in length; spathes as in the male; spathellae ovate, acute, about 3 mm. long; spikelets approximate, shortly pedunculate, ovate 2- or 3-flowered, 6–7 mm. long; bracts broadly ovate, obtuse, obtusely mucronulate, coriaceous, 3–3·5 mm. long; empty bracts about 3, smaller; perianth ovate, rounded on the dorsal surface and flattened on the ventral, 4–5 mm. long; segments ovate, subacute, coriaceous, thinner at the margins; the outer lateral carinate, sometimes shortly and sparsely villous on the carina; inner segments exceeding the outer in length by about 1 mm.; ovary oblong, obtusely 3-lobed, 3-celled; styles 3, distinct.

South Africa: without precise locality, *Marloth*, 10158, ♂ and ♀ (type).

Cape Province—Caledon Div.: mountains above Kogel Bay, *Stokoe in Bolus Herb.*, 17662; ♀.—Paarl Div.: mountain above the waterfall in French Hoek Valley, *Stokoe in Bolus Herb.*, 17251, ♂ and ♀.—Worcester Div.: Onklaarberg, *Stokoe*, 1210, ♂.

10. C. aggregatum, *Pillans*, comb. nov.: **Dovea aggregata,** *Mast. in Fl. Cap.*, vii, 101 (1897) !.

Stems erect, simple, stout, slightly wrinkled, 6–11 dm. high, about 3 mm. in diameter at the middle; sheaths mostly falling before the flowers mature, lanceolate-oblong, acute, mucronate, smooth, or somewhat nervose at apex, coriaceous, narrow-membranous at the margins, chestnut-brown, the medium about 4 cm. long; male inflorescence paniculate-cymose, densely many-flowered, about 4 cm. long; spathes deciduous, oblong, acute, mucronate, coriaceous, 1·5–2 cm. long; spathellae inconspicuous; spikelets compact, broadly ovate, 4–5-flowered, 3·5–4 mm. long; bracts closely convolute, broadly ovate, obtuse, slightly angular on their upper parts, coriaceous, 2–2·5 mm. long; perianth oblong, flattened on its inner side, rounded on its outer, 2·5–3 mm. long; outer segments ovate, obtuse, cartilaginous; the lateral villous-carinate; the anterior dorsally rounded; inner segments oblong, obtuse, deeply concave on the inner side, cartilaginous, scarcely twice as long as the inner; female inflorescence narrowly paniculate-cymose, interrupted in its lower half, 7–10 cm. long; spathes

subpersistent, loosely convolute, oblong, acute, mucronate, coriaceous, narrow-membranous at the margins, smooth, or slightly nervose at the apex, chestnut-brown, the lower 2·5 cm. long; spathellae inconspicuous; branches of the inflorescence erect, 1·5–2·5 cm. long; spikelets ovate, 2–3-flowered, 4–5 mm. long; bracts ovate, subacute, dorsally rounded, or with a prominent median nerve, coriaceous, 3–3·5 mm. long; perianth oblong, trigonous, 4 mm. long; outer segments oblong-ovate, acute, coriaceous; the lateral villous-carinate; the anterior dorsally rounded, glabrous; inner segments oblong, acute, cartilaginous, slightly exceeding the outer; ovary trigonous, 3-celled; styles 3, separated; fruit 3-seeded.

South Africa: Cape Province—near Cape Town, *Zeyher*, ♀.—Caledon Div.: Genadendal, *Drège*, 1622, ♀, *Schlechter*, 9870, ♂, 9871, ♀.

11. C. mucronatum, *Pillans*, comb. nov.: **Restio racemosus,** *Poir. in Lam., Encycl. Meth.*, vi, 177 (1804), quoad pl. fem.; [*Lam., Ill.*, t. 804, fig. 4, *a–e* (1798)]; *Poir. in Lam., Tableau Encycl.*, iii, 400 (1823), quoad pl. fem.: **R. mucronatus,** *Nees in Linnaea*, v, 660 (1830)!: **Elegia panicoides,** *Kunth, Enum.*, iii, 470 (1841)!; *Drège, Zwei Pfl. Documente*, 89 (1844); *Steud., Synops.*, ii, 262 (1855): **E. mucronata** [*Reichenb. Herb. ex Nees in Linnaea*, v, 660 (1830)!, nomen]; *Kunth, Enum.*, iii, 475; *Drège in Linnaea*, xx, 243 (1847); *Steud., Synops.*, ii, 262: **Dovea mucronata,** *Mast. in Journ. Linn. Soc.*, x, 251 (1868)!; *in DC. Monog. Phan.*, i, 308, t. 2, figs. 1–6, t. 5, fig. 6 (1878); *in Journ. Linn. Soc.*, xxi, 590, No. 13 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895); *Mast. in Fl. Cap.*, vii, 103 (1897); *Marl., Fl. S. Afr.*, iv, p. 62, t. 15, A1, A2, fig. 14B, 1–5, t. 17B (1915).

Stems arising sporadically from creeping rhizomes, erect, stout, solid, terete, internally soft in substance, smooth, 6–18 dm. high, 4–7 mm. in diameter at the middle, up to 1 cm. at base; sheaths persisting during the flowering period, loosely convolute, somewhat spreading in their upper parts, linear-oblong, acute, stoutly mucronate, coriaceous, more or less nervose, narrow-membranous at their margins, reddish brown, 8–16 cm. long; male inflorescence paniculate-cymose, oblong to linear-oblong, narrowed at apex, dense, mostly 1–1·5 dm. long, up to 2 dm. long; spathes sheath-like but smaller, expanded and falling during the flowering period, subcoriaceous or chartaceous, buff or pale reddish brown; branches of the inflorescence erect, mostly 1·5–2·5 cm. long; spathellae linear-lanceolate, acuminate, aristate, membranous, 5–7 mm. long; spikelets orbicular to oblong, laxly 2–10-flowered, 5–8 mm. long; bracts erect-spreading, deltoid to orbicular, abruptly tapered at the apex into a short awn, membranous, firm at the median nerve, 1·5–2 mm. long; perianth almost entirely nude, oblong, acute, subsessile, 3·5–4 mm. long; outer segments orbicular, mucronate, obtusely carinate, subcartilaginous, membranous at the margins, red-brown, scarcely half as long as the inner; inner segments oblong,

obtuse, mucronate or mucronulate, with strongly involute margins, somewhat carinate or smooth on the upper half, cartilaginous; female inflorescence paniculate-cymose, narrow-oblong, 7–15 cm. long; spathes persistent, sheath-like, erect, flattened in their upper parts, cartilaginous, chartaceous in their upper parts, pale at the margins, 5–10 cm. long; branches of the inflorescence shorter than in the male; spathellae lanceolate, acuminate, mucronate, membranous, rigid at the scabrid, median nerve, 0·5–1·5 cm. long; spikelets oblong, laxly 2–4-flowered, about 1 cm. long; bracts erect-spreading, spathella-like, broadly deltoid, acuminate, subulate-mucronate, membranous, 2 mm. long; perianth broadly oblong, obtuse, trigonous, pale reddish brown, 4·5–6 mm. long; outer segments broadly ovate, acute, mucronate, cartilaginous, two-thirds of the length of the inner; the lateral slightly carinate; the anterior dorsally rounded; inner segments oblong-ovate, acute, mucronate, rather flattened than rounded; ovary 3-celled, trigonous, broadly oblong, blackish; styles 3, stout; fruit 3- or rarely, by abortion, 2-seeded; seeds elliptic-ovate, with many longitudinal, membranous ridges, red.

South Africa: without precise locality, *Masson*, ♂, *Verreaux*, ♂, *Drège*, 105, ♂, *Sieber*, ♂ and ♀, *Thom*, ♂ and ♀, *Berg*, ♀.

Cape Province—Cape Div.: Table Mt., *Burchell*, 563, ♂, *Ecklon and Zeyher in Herb. Mus. Austr.-Afr.*, 12984, ♂, 12985, ♂ and ♀, *Bolus*, 2878, ♂, 4468, ♀, *MacOwan*, 2514, ♂, *Wilms*, 3784, ♂, *Marloth*, 3133, ♂, 7240, ♂ and ♀, *Wolley-Dod*, 1733, ♂, *Galpin*, 4798, ♂ and ♀, *R. Fries*, ♀, *Dümmer*, 1818, ♂ and ♀, *Rogers*, 17756, ♂, *Garside*, 200, ♂ and ♀, *Moss*, 7862, ♂ and ♀, *Pillans*, 4377, ♂ and ♀.—Caledon Div.: Steenbras, *Pillans in Bolus Herb.*, 16895, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 34 partly, ♂ and ♀.—Riversdale Div.: Garcia's Pass, *Galpin*, 4797, ♂ and ♀; near Kampsche Berg, *Burchell*, 7026, ♂ and ♀, *Muir*, 2893, ♂ and ♀; Lange Bergen, *Schlechter*, 1912, ♂ and ♀.

The greater part of the description of *Restio racemosus*, Poiret, in *Lamarck's Encycl. Meth.* (1804), applies to the male plant of an Elegia which Persoon, in 1807, published as his *E. racemosa*. I have therefore used for the present species that trivial name which comes next in order of priority.

12. C. paniculatum, *Pillans*, comb. nov.: **Dovea paniculata,** *Mast. in Journ. Linn. Soc.*, xxi, 577 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 513 (1895); *Mast. in Fl. Cap.*, vii, 102 (1897).

Stems caespitose, erect, simple, slender, terete, finely wrinkled and puncticulate, 6–8 dm. high, 1·5–1·75 mm. in diam. at the middle; sheaths often persisting during the flowering period, oblong-lanceolate, acute or acuminate, chartaceous and slender-aristate at the apex, coriaceous, nervose, red-brown, yellow-spotted, 2–3 cm. long; male inflorescence

paniculate-cymose, narrow, lax, 5–10 cm. long; spathes mostly persisting during the flowering period, flattened, involute at the upper margins, oblong to linear-lanceolate, acute, slender-aristate, thinly coriaceous or chartaceous, nervose, usually 2·5–3 cm. long; branches of the inflorescence several at each node, shorter than the subtending spathe; spikelets laxly many-flowered, 6–10 mm. long; bracts erect or spreading, distinct from the flowers, linear-lanceolate below, tapering upwards into a very slender, filiform awn, hyaline-membranous, mostly 7–9 mm. long, with a prominent midrib; perianth pedicellate, 3 mm. long; outer segments linear-lanceolate, acute, mucronate, chartaceous, with a rigid median nerve; inner segments oblong-lanceolate, acute, mucronulate, thinly cartilaginous, nearly twice the length of the outer; female inflorescence paniculate-cymose, narrow, 3–6 cm. long; spathes as in the male; spikelets 1-flowered, 2–3 in the axil of each spathe; bracts as in the male but larger and red at base; perianth pedicellate, oblong, acuminate, trigonous, 7–7·5 mm. long; outer segments ovate-lanceolate, attenuate, mucronate; inner segments ovate-lanceolate, mucronate, distinctly shorter than the outer; ovary 3-celled, trigonous, ovate; styles 3, broad-based, separated.

South Africa: Cape Province—Caledon Div.: mountains between Villiersdorp and French Hoek, *Bolus*, 7483, ♀.—Paarl Div.: Drakenstein Mts., near Bain's Kloof, *Bolus*, 4081, ♀, 4082, ♂, 4097, ♀, 4098, ♂.—Tulbagh Div., on the Witsenberg, *Burchell*, 8719, ♂.—Ceres Div.: mountains at Ceres, *Bolus*, 5293, ♂, *Marloth*, 1698, ♂; Mitchell's Pass, *Schlechter*, 9963, ♀. Worcester Div.: Du Toit's Kloof, *Drège*, 125 partly, ♀, 1643, ♂ and ♀, 1651 partly, ♂; peak north of Chavonnesberg, *Andreae*, 839, ♀; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17663, ♂.

13. C. Andreaeanum, *Pillans*, sp. nov.; culmis caespitosis erectis simplicibus teretibus; inflorescentia mascula paniculatim cymosa; spiculis plurifloris; bracteis linearibus acuminatis hyalino-membranaceis; perianthio pedicellato; segmentis lanceolatis; interioribus oblongo-lanceolatis externis duplo longioribus; inflorescentia feminea oblonga, spicatim cymosa; spathis persistentibus; spiculis 1-floris; perianthii segmentis subaequalibus; exterioribus ovatis acuminatis; ovario trilobo; stylis tribus.

Stems caespitose, erect, simple, rigid, terete, finely wrinkled, 5–7 dm. high, about 2 mm. in diameter at the middle; sheaths mostly persistent during the flowering period, loosely convolute, oblong-ovate, obtuse or rounded at apex, subulate-mucronate, coriaceous, narrowly cartilaginous at the margins, conspicuously nervose-striate, reflecting a golden or bronze iridescence, 2·5–3 cm. long; male inflorescence densely paniculate-cymose, oblong or narrow-oblong, 5–10 cm. long; spathes caducous, sheath-like; branches of the inflorescence very numerous, tufted, several- or many-

flowered, 1–2 cm. long; bracts equalling the flowers in number, widely spaced on the rhachillae, linear, acuminate, hyaline-membranous, 4–6 mm. long; perianth pedicellate, oblong, ferruginous, 3·5–4 mm. long; outer segments lanceolate, acuminate, cartilaginous, equal; the inner oblong-lanceolate, acute, cartilaginous, twice the length of the outer; female inflorescence paniculate-cymose, oblong or linear-oblong, 3–6 cm. long; spathes persistent, sheath-like; branches of the inflorescence 1 or 2 in the axil of each spathe by which they are partly hidden, 1- or 2-flowered; perianth stoutly pedicellate, broadly ovate, obtusely trigonous, horn-coloured, 4·5–5 mm. long; outer segments broadly ovate, acuminate, mucronulate, obtusely angled on the median nerve, coriaceous, thinner at the margins; the inner broadly ovate, acute, mucronulate, cartilaginous, slightly longer than, slightly shorter than, or equalling the outer; ovary obtusely trigonous, surmounted by a lobed, horny cap, with channelled lobes above the angles; styles 3, widely separated, with their bases merged in the horny stylopodium.

South Africa: Cape Province—Paarl Div.: mountains south of Wemmer's Hoek, Andreae, 813, ♂ and ♀ (type).

14. C. chartaceum, *Pillans*, comb. nov.: **Dovea chartacea,** *Pillans in Ann. Bolus Herb.*, iii, 144 (1922).

Stems caespitose, erect, simple, terete, rigid, smooth, about 4 dm. high, 2·5–2·75 mm. in diameter at the middle; sheaths loosely convolute, broadly oblong, obtuse, mucronate, coriaceous, thinner at the margins, prominently nervose-striate, straw-colour, pale brown at the apex, with golden iridescence, 2–2·5 cm. long; female inflorescence spicate-cymose, densely many-flowered, linear-oblong, about 6 cm. long; spathes persistent, loosely convolute or erect-spreading and flattened, linear-oblong at base to oblong-lanceolate at apex, acute, chartaceous, nervose, soon lacerate, buff or light brown, mostly 2–2·5 cm. long; spikelets usually 2 in the axil of each spathe, subsessile, conical, compressed, 4–6-flowered, 1·2–1·5 cm. long; bracts closely convolute in their lower parts, erect-spreading in their upper, oblong-lanceolate, long-attenuate, filiform-aristate, lacerate and membranous at their margins, otherwise cartilaginous and chestnut-brown, 1·2–1·5 cm. long (including awn); perianth distinctly stipitate, oblong-lanceolate, trigonous, often somewhat curved in the upper part, dark chestnut-brown, 9–10 mm. long; segments oblong-lanceolate, acuminate, cartilaginous; the outer slender-aristate, membranous at their margins, nearly twice as long as the inner; the lateral slightly carinate; ovary oblong, 3-lobed, 3-celled, chestnut-brown; styles 3, separated; fruit deeply 3-lobed, 3-seeded; seeds elliptic, with a depressed, conical funicle, smooth, 1·75 mm. long.

South Africa: Cape Province—Stellenbosch Div.: top of Sneuwkop, *Marloth*, 3635, ♀ (type).

Allied to *C. paniculatum*, Pillans, but distinguished chiefly with several-flowered spikelets in the female plant and with the outer perianth-segments being aristate.

15. C. nitidum, *Pillans*, comb. nov.: **Dovea nitida,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 6 (1900) !.

Stems caespitose, erect, simple, rather slender but wiry, rugulose, 5–6 dm. high, 1–1·25 mm. in diameter at the middle; sheaths mostly persistent during the flowering period, slightly convolute or flattened, oblong-lanceolate, acute, mucronate, thinly coriaceous, finely nervose-striate, light brown, 2–3 cm. long; male inflorescence dense, oblong, paniculate-cymose, 1·5–5 cm. long; spathes persistent, erect-spreading, flattened, linear-lanceolate, acute, mucronate, cartilaginous or chartaceous, 1–1·5 cm. long; spikelets densely many-flowered, oblong, about 1 cm. long; bracts conspicuous, erect-spreading, flattened, linear-lanceolate, long-acuminate, aristate, chartaceous, often deeply lacerate at their sides, purple at base, the upper parts pale, 8–12 mm. long; perianth stipitate, oblong, acute, trigonous in its lower part, 3·5–5 mm. long; outer segments oblong-lanceolate, acute, mucronulate, coriaceous; the lateral slightly carinate; the anterior dorsally rounded; inner segments lanceolate, acute, mucronate, dorsally rounded, coriaceous, twice or slightly more than twice as long as the outer; female inflorescence resembling the male but somewhat broader; spikelets rounded, about 6-flowered; spathes and bracts as in the male; perianth stipitate, oblong, trigonous, chestnut-brown, 4–6 mm. long; outer segments lanceolate, acute, mucronulate, cartilaginous, subequal; the lateral sharply carinate; inner segments lanceolate, acuminate, mucronulate, cartilaginous, twice as long as the outer, or scarcely longer in the fruiting period; ovary ovate, 3-lobed, 3-celled; styles 3, free, short.

South Africa: Cape Province—Paarl Div.: mountain above the waterfall, French Hoek Valley, *Stokoe in Bolus Herb.*, 17252, ♂ and ♀.—Ceres Div.: Skurfde Bergen, near Wagenbooms River, Koude Bokkeveld, *Schlechter*, 10160, ♂, 10161, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 1651 partly, ♂; Matroosberg, *Marloth*, 2228, ♂, 10156, ♀.

16. C. capitatum, *Pillans*, comb. nov.: **Askidiosperma capitatum,** *Steud., Synops.*, ii, 257 (1855) !; *Mast. in Journ. Linn. Soc.*, x, 247 (1868); *in DC. Monog. Phan.*, i, 304, t. i, figs. 32–36 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 98 (1897).

Stems caespitose, simple, terete, slender, wrinkled, 3–4 dm. high, about 1·5 mm. in diameter; sheaths persisting during the flowering period, eventually falling, ovate-oblong, rounded at apex, coriaceous, narrowly membranous at the upper margins, distinctly longitudinally striate, bluish-green, 1·2–1·5 cm. long, with a stout mucro 2·5–3 mm. long; female inflorescence a dense, oblong, or conical panicle, 1·5–3 cm. long; spathes

erect-spreading, lanceolate, acute, coriaceous, 1–1·5 cm. long; spikelets solitary, several or many, sessile, conical or oblong, many-flowered; bracts erect-spreading, oblong-lanceolate, acuminate, aristate, flattened in the lower part, twisted towards the apex, cartilaginous, pale, about 1 cm. long; perianth shortly stipitate, compressed, somewhat arcuate, narrow-oblong, 5–6·5 mm. long; outer segments oblong-lanceolate, acuminate, cartilaginous; the lateral carinate; inner segments oblong-lanceolate, acute, chestnut-brown, distinctly exceeding the outer; ovary compressed, ovate, 2-celled; styles 2, free, short and stout; fruit 2-lobed, 2-seeded, oblong, rounded at apex.

South Africa: Cape Province—Clanwilliam Div.: Ezelsbank, on the Cedar Berg, alt. 3000–4000 feet, *Drège*, 2510, ♀.

Tribe 2. Willdenowieae.

III, ELEGIA, *Linn., Mant.*, ii, 162 (1767); *Linn., Mant. Plant. altera*, p. 297 (1771); *Willd., Sp. Pl.*, iv, pars 2, p. 729 (1806); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 311 (1811); ed. *Schultes*, 81 (1823); *Endl., Gen. Pl.*, 122 (1836); *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840); *Kunth, Enum.*, iii, 460 (1841), partim; *Meisner, Gen. Pl.*, 408 (1842); *Steud., Synops. Pl.*, ii, 261 (1855), partim; *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 415 (1868); *Mast. in Journ. Linn. Soc.*, x, 239 (1868); *in DC. Monog. Phan.*, i, 351 (1878), excl. *Chondropetalum*; *Benth. et Hook., Gen. Pl.*, iii, 1032 (1883), excl. *Chondropetalum*; *Hiern. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 8 (1888), partim; *Mast. in Fl. Cap.*, vii, 104 (1897): **Lamprocaulos,** *Mast. in DC. Monog. Phan.*, i, 349, tab. iii, figs. 22–28, tab. v, fig. 13 (1878); *in Fl. Cap.*, vii, 114.

Flowers dioecious. Male spikelets many or few in panicled cymes, oblong, ovate or orbicular, few- or many-flowered, with few or no empty bracts. Perianth trigonous or subterete, often arcuate; segments 6, the inner longer than the outer. Anthers ovate-oblong, shortly apiculate. Rudimentary ovary with 2 or 3 minute styles or absent. Female spikelets many in panicled cymes or few in spicate cymes, hidden by the spathes, few- or 1-flowered, with few or no empty bracts at the base (spathellae are occasionally bract-like). Perianth ovate or oblong, trigonous or subterete; segments equal or unequal, the outer lateral often carinate. Staminodes minute or absent. Ovary trigonous, subterete or compressed, 1-celled; styles 2 or 3, distinct or rarely connate in the lower half. Fruit 3- or 2-angled, occasionally keeled on the angles, indehiscent.

Flowering stems tufted or arising from creeping rhizomes, erect, simple or branched, terete, occasionally more or less fistular, with deciduous or persistent leaf-sheaths. In a few species much-branched barren stems occur.

The genus is endemic.

Key based on Characters in the Female Plants.

* Stems bearing many verticillate or subverticillate, barren branchlets :
Inflorescence 15–20 cm. long ; spathes deciduous . . . (1) *verticillaris.*
Inflorescence 6–12 cm. long ; spathes persistent . . . (2) *equisetacea.*
** Stems bearing few or many branches, not arranged as above, most of which bear fully developed inflorescences :
Styles 3 . . . . . (4) *Muirii.*
Styles 2 :
Styles slender, curled in their upper parts and with the free parts, having the stigmatic surface, longer than the stylopodium . . . (3) *stipularis.*
Styles stout, not as above :
Ovary much exceeding the perianth in length . . . (5) *prominens.*
Ovary not exceeding the perianth in length :
Inflorescence 3–5 cm. long ; spathes 1·5–2·5 cm. long ; perianth 2–3·5 mm. long. . . . . (6) *Neesii.*
Inflorescence 8–12 cm. long ; spathes 4·5–6 cm. long ; perianth 5–5·5 mm. long. . . . . (7) *grandis.*
*** Stems not bearing branches, or if these be present they are barren or very rarely bearing undersized inflorescences :
Stems distinctly fistular, the diameter of the passage being more than half that of the stem . . . . . (18) *fistulosa.*
Stems solid or rarely having a narrow internal passage :
Leaf-sheaths persistent, closely convolute . . . . (14) *asperiflora.*
Leaf-sheaths deciduous, mostly loosely convolute or expanded :
Stems of dried plants compressed above the base :
Bracts and perianth-segments lacerate at their margins, (14) *asperiflora*, var. *lacerata.*
Bracts entire ; outer perianth-segments finely lacerate at the apex, (15) *coleura.*
Stems of dried plants terete or rarely slightly compressed in their upper parts :
Stems slender-wiry, mostly less than and rarely exceeding 5 dm. in height and 1·25 mm. in diam. at the middle ; leaf-sheaths not more than 4 cm. in length :
Stems aggregated in one dense tuft :
Spathellae conspicuous, aristate, 1-1·2 cm. long. . (13) *fastigiata.*
Spathellae inconspicuous or absent, 0·5 cm. or less in length :
Inflorescence linear to oblong, 2–4 cm. long ; spathes lanceolate to oblong, mostly erect and dorsally convex, 1-1·5 cm. long, 3–6 mm. in diam. ; spikelets 2–8-flowered . . . (11) *parviflora.*
Inflorescence lanceolate or oblong-lanceolate, 2·5–6 cm. long ; spathes lanceolate or ovate-lanceolate, flattened, mostly recurved at apex, 1·5–3 cm. long ; spikelets 4- or 5-flowered . . (12) *spathacea.*
Inflorescence linear, 8–10 cm. long ; spathes flattened in their upper parts, recurved at apex, about 2 cm. long ; spikelets 2- or 3-flowered, (12) *spathacea*, var. *attenuata.*
Stems not aggregated in one dense tuft but arising from creeping rhizomes :
Stems in many tufts of 2–6 on the same plant, 1–2·5 dm. high ; leaf-sheaths 0·7–1 cm. long. . . . . (9) *Verreauxii.*
Stems sporadic, 2–4 dm. high ; leaf-sheaths 1·2–2 cm. long, (10) *vaginulata.*
Stems closely arranged like the teeth of a comb, 1–2 dm. high ; leaf-sheaths 1–1·5 cm. long . . . . . (8) *squamosa.*

Stems rigid-wiry or stout, mostly exceeding 5 dm. in height (in *E. intermedia* 4–6 dm.), 1·25–5 mm. in diam. at the middle; leaf-sheaths mostly exceeding 4 cm. in length:
Bracts aristate:
Awns 3–4 mm. long; leaf-sheaths light brown . . . (16) *glauca.*
Awns at least 5 mm. long; leaf-sheaths chestnut-brown, (25) *cuspidata.*
Bracts not aristate, at most subulate-mucronate:
Spikelets chestnut-brown or blackish; inflorescence 1–5 dm. long; flowers roundish . . . . . (24) *Galpinii.*
Spikelets brown; inflorescence 1–3 dm. long; flowers oblong or ovate-oblong:
Spathes chartaceous or membranous . . . (17) *intermedia.*
Spathes coriaceous:
Inflorescence linear, tapered upwards in its upper half, usually more than twice as long as broad; spathes erect or somewhat erect-spreading at the apex, imbricate; spikelets quite hidden by the spathes:
Spikelets 1-3-flowered; flowers 2–3·5 mm. long; inflorescence 6–18 cm. long . . . . . (21) *racemosa.*
Spikelets 2- or 3-flowered; flowers 2·5–3 mm. long; inflorescence 10–30 cm. long . . . . . (23) *thyrsoidea.*
Inflorescence oblong, linear-oblong or oblanceolate, shortly, if at all, narrowed at the apex, usually about twice as long as broad; spathes suberect or erect-spreading; except in *E. juncea* the spikelets are exposed or only partly hidden by the spathes:
Spikelets quite or almost quite hidden by the spathes or, in abnormal inflorescences, by the spathellae; spathes persistent . . . . . (19) *juncea.*
Spikelets exposed or partly hidden by the spathes; spathes subpersistent or deciduous:
Spikelets 3- or 4-flowered; spathes light brown; bracts mucronate; perianth-segments mucronulate; ovary obovoid or pyriform, tapering towards the base, obliquely trigonous winged on the projecting angles . (20) *thyrsifera.*
Spikelets 5–8-flowered; spathes chestnut-brown; bracts and perianth-segments muticous; ovary ovate or oblong-ovate, trigonous, keeled on the lateral projecting angles, (22) *fenestrata.*

1. E. verticillaris, *Kunth, Enum.*, iii, 471 (1841)!; *Drège, Zwei Pfl. Documente*, 82 (1844); *Drège in Linnaea*, xx, 243 (1847); *Steud., Synops. Pl.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 244 (1868); *in DC. Monog. Phan.*, i, 351 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895); *Mast. in Fl. Cap.*, vii, 105 (1897); *Marloth, Fl. South Africa*, iv, fig. 15, p. 64 (1915): **Restio verticillaris,** *L. f., Suppl.*, 425 (1781)!; *Linn., Syst. Veg.*, ed. 14, p. 881 (1784); *Thunb., Diss.*, 19, fig. 7 (1788); *in Usteri, Delect.*, i, 53, tab. 2, fig. 7 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Linn., Syst. Veg.*, ed. 15, p. 924 (1797); *Poir. in Lam., Encycl. Meth.*, vi, 169 (1804); *Willd., Sp. Pl.*,

iv, pars 2, 727 (1806); *Pers., Synops. Pl.*, ii, 607 (1807); ***Thunb.**, Fl. Cap.*, ed. 1, p. 336 (1811); ed. *Schultes*, 88 (1823); *Spreng., Syst. Veg.*, i, 186 (1825); *Nees in Linnaea*, v, 661 (1830); *Nees in Linnaea*, vii, 617 (1832), excl. syn. *Reichenbach*; *Mast. in Journ. Linn. Soc.*, x, 244; *op. cit.*, xiv, 418, 419 (1875); *op. cit.*, xxi, 590 (1885): **R. equisetaceus,** *Reichenbach ex Steud. in Flora*, 1829, i, 133 !.

Stems erect, stout, terete, solid, wrinkled, about 2 m. high, 6–8 mm. in diameter at the middle, with whorls of simple or compound slender branchlets at the nodes; sheaths deciduous, subpersistent on the upper parts during the flowering period, expanded, linear-oblong or lanceolate, acute, subulate-mucronate, coriaceous, striate and red-brown on their outer surface, smooth, pale straw-colour and shiny on their inner, mostly about 1 dm. long on the lower half of the stems; male inflorescence paniculate, narrow-oblong, usually broadest at its base and tapering upwards, much branched and dense, mostly 1·5–2·5 dm. long, up to 4·5 dm.; spathes soon falling, sheath-like but smaller, subcoriaceous or chartaceous; spathellae inconspicuous, oblong, obtuse, hyaline; spikelets orbicular to oblong, mostly 5–7-flowered, 3–4 mm. long; bracts closely convolute, broadly ovate, obtuse or subacute, finely lacerate at their margins, hyaline, ·75–1 mm. long; perianth oblong to cuneate, 1·75–2 mm. long; outer segments oblong-ovate, acute, membranous; the inner oblong, obtuse, membranous, twice as long as the outer; female inflorescence resembling the male, densely many-flowered, mostly 1·5–2 dm. long, up to 3 dm.; spathes as in the male but smaller; spathellae inconspicuous, broadly deltoid, mucronate, membranous, often bract-like; spikelets broadly cuneate to suborbicular, laxly 2–5-flowered, 2·5–5 mm. long; bracts rather loosely convolute, broadly ovate to deltoid, acute or obtuse, membranous, 1·25–2 mm. long; perianth oblong, 3-sided, 2·5–3 mm. long; outer segments linear-oblong, acute, membranous, cartilaginous at the midrib; the lateral somewhat navicular, obtusely angled; inner segments linear-oblong, obtuse, cartilaginous, rugulose, shortly exceeding the outer; ovary oblong, tapered at the apex into a short stylopodium, 3-angled, red; styles 3, distinct, stout at base.

South Africa: without precise locality, *Oldenburg*, 1290, ♂, *Masson*, ♂ and ♀, *Thunberg*, ♂ and ♀, *Dr. Maton*, ♀, *Dr. Mackrell*, ♂ and ♀, *Wallich*, ♂, *Ludwig*, ♀, *Ecklon*, 837, *Mund and Maire*, ♂ and ♀.

Cape Province—Cape Div.: Orange Kloof, *Dümmer*, 1038, ♂.—Stellenbosch Div.: Stellenbosch, *Alexander*, ♀, *Marloth*, 5695, ♂, 5995, ♂; Jonker's Hoek, *Garside*, 32 ♂, 1159, ♀.—Paarl Div.: near French Hoek, *Phillips*, 1362, ♀; Bain's Kloof, *Bolus*, 4101, ♂.—Caledon Div.: River Zonder Einde, *Zeyher*, 4344, ♂ and ♀; hot springs at Caledon, *Zeyher*, ♂; Hermanus, *Burtt-Davy*, 18536, ♀; Genadendal, *Schlechter*, 9806, ♂, 9807, ♀.—Tulbagh Div.: Roode Zand, *Thunberg*, ♀; Tulbagh Kloof, *Scott-Elliot*, ♀; Sneuwgat,

Great Winterhoek, *Phillips*, 1687.—CERES DIV.: Mitchell's Pass, *Bolus*, 9660, ♂; Mostert's Berg, near Ceres, *Bolus*, 9659, ♀; Laaken Vley on the Matroosberg, *Phillips*, 2116, ♀.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 1609, ♂ and ♀; mountains above Worcester, *Rehmann*, 2568, ♂.—CLANWILLIAM DIV.: Olifants River, *Zeyher in Herb. Mus. Austr.-Afr.*, 1253, ♂ and ♀, 1256, ♂.—RIVERSDALE DIV.: about the waterfall at south entrance to Garcia's Pass, *Burchell*, 6992, ♂ and ♀; Lange Bergen, *Schlechter*, 1910, ♂; mountain sides in Glen Leith, *Muir*, 3077, ♂ and ♀; Phisantefontein, north slopes of Lange Bergen, *Muir*, 3188, ♂.—LADISMITH DIV.: Seven Weeks Poort, *Phillips*, 1530.—UNIONDALE DIV.: Avontuur, *Bolus*, 2498, ♂ and ♀; Wagenbooms River *Fourcade*, 2527, ♂ and ♀; along the Haarlem River, *Schönland*, 3087, ♀.—HUMANSDORP DIV.: near "Wagenboom Station," north side of Kromme River, *Burchell*, 4845, ♀.

This is Burchell's *Restio squamulosa* in manuscript. The spelling "verticillatus" in *Spreng., Syst. Veg.*, i, 186, is evidently an error.

2. E. equisetacea, *Mast. in Journ. Linn. Soc.*, xxi, 583 (1885)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 106 (1897).

Stems erect, rigid, with subverticillately arranged slender branches or less often simple, terete, finely wrinkled and occasionally white-speckled, 8–10 dm. high, 2–3 mm. in diameter at the middle; branches simple or with a tuft of branchlets at each node; sheaths on the stems caducous, oblong, acute, mucronate, coriaceous, chartaceous at apex and margins, tessellate with raised cells, brown, 2·5–3 cm. long; male inflorescence paniculate-cymose, narrow, densely many-flowered, interrupted in its lower parts, mostly 1–1·5 dm. long, up to 2·5 dm.; spathes caducous, sheath-like; spathellae inconspicuous, lanceolate, chartaceous; spikelets compact, oblong, secundiflorus, 4–6-flowered, 2·5–3 mm. long; bracts closely convolute, rounded, membranous, 1 mm. long; perianth oblong, 1·5–1·75 mm. long; outer segments ovate-oblong, acute, membranous, brown; the lateral slightly carinate; inner segments oblong, obtuse, cartilaginous, twice as long as the outer; female inflorescence spicately cymose, linear, compact, many-flowered, mostly 6–12 cm. long, up to 17 cm.; spathes persistent, expanded, sheath-like; spathellae numerous and conspicuous, lanceolate to ovate-lanceolate, acute, mucronulate, with a prominent median nerve or carinate, chartaceous, up to 1·5 cm. long; spikelets compact, 3–5-flowered, 2–2·5 mm. long; bracts closely convolute, broadly ovate, obtuse, membranous, about 1·5 mm. long; perianth oblong, rounded on the exterior and flattened on the inner sides, scarcely 2 mm. long; segments oblong, obtuse, cartilaginous; the outer lateral navicular, carinate; inner segments slightly exceeding the outer; ovary compressed; styles 2 or 3, free.

South Africa: Cape Province—SWELLENDAM DIV.: at the base of the

Lange Bergen, near Swellendam, *Burchell*, 7429, ♀; Puspas Vley, near Swellendam, *Ecklon and Zeyher*, ♂ and ♀.—George Div.: Silver River, *Schlechter*, 5879, ♀.—Knysna Div.: Concordia, *Galpin*, 4807, ♂ and ♀, 4808, ♂ and ♀; without precise locality, *Keet*, 473, ♂ and ♀.—Humansdorp Div.: flats at Witte Els Bosch, *Fourcade*, 1373, ♂ and ♀.—Uitenhage Div.: Van Staden's Berg, *Burchell*, 4715, ♂.

3. E. stipularis, *Mast. in Journ. Linn. Soc.*, xxi, 587 (1885)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895); *Mast. in Fl. Cap.*, vii, 112 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900): **Restio parviflorus,** vars. *β et γ, Nees in Linnaea*, v, 655, 656 (1830)!.

Stems caespitose or sporadic on creeping rhizomes, erect, rigid in their lower parts, much branched from about the middle upwards, rarely simple but then accompanied by barren branched stems, terete, wrinkled, 4–6 dm. high, 2–2·5 mm. in diameter in the unbranched part; sheaths subpersistent; the lower convolute or somewhat expanded, oblong, acute, coriaceous, membranous at the margins, striate, red-brown, 1·5–2 cm. long; the upper expanded, slightly smaller; male inflorescence paniculate-cymose, narrow, mostly 3–6 cm. long; spathes persistent, sheath-like, expanded, 1·5–2 cm. long; branches of the cymes short, densely many-flowered; spathellae inconspicuous, lanceolate, hyaline, less than or rarely exceeding 5 mm. in length; spikelets ovate, 2–4-flowered, 2–3 mm. long; bracts closely convolute, roundish, hyaline-membranous, 1·5–1·75 mm. long; perianth oblong, nearly terete, 1·5–2·25 mm. long; outer segments ovate, obtuse, dorsally rounded, cartilaginous; the anterior rather smaller than the lateral; inner segments oblong, rounded and somewhat galeate at the apex, cartilaginous, twice as long as the outer; female inflorescence spiciform, linear-cylindric, mostly 3–5 cm. long; spathes persistent, imbricate, loosely convolute or erect-spreading, sheath-like, mucronulate, 1·2–1·5 cm. long; cymes solitary at each node of the inflorescence, hidden by the spathes, very short, bearing two spikelets, one with a solitary fertile flower, the other with a minute aborted flower; spathellae absent; bracts closely clasping the flowers, ovate-oblong, rounded at apex, deeply concave on the inner side, hyaline-membranous, scarcely equalling the flowers in length; perianth sessile, ovate or ovate-oblong, somewhat compressed, 1·75–2 mm. long; segments oblong, obtuse, hyaline-membranous; the inner slightly exceeding the outer; ovary oblong, somewhat compressed, keeled on the lateral angles, purplish, tapered at the apex into a yellowish stylopodium; styles 2, united about a third of their length from the base, diverging in their upper parts.

South Africa: without precise locality, *Thunberg*, ♂, *Masson*, ♂, *R. Brown.* ♂, *Boivin*, 502, ♂.

Cape Province—Cape Div.: mountains about Simon's Town, *Harvey*,

310, ♀, *Pappe in Herb. Mus. Austr.-Afr.*, 12966, ♂ and ♀, *Bolus*, 15680, ♂ and ♀, *Pillans*, 3971, ♂ and ♀, *Rogers*, 11215, ♂; Patrys Vley, *Wolley-Dod*, 1235, ♀; Cape Point, *Marloth*, 3185, ♀, 3186, ♂; Tiger Berg, *Ecklon and Zeyher*, ♂; on the Muizenberg, *Moss*, 7840, ♀.—Caledon Div.: Grietje's Gat, *Ecklon and Zeyher in Herb. Mus. Austr.-Afr.*, 12967, ♂ and ♀, 12969, ♂; Steenbras, *Rogers*, 11215, ♀; Houwhoek, *Schlechter*, 5487, ♂.—Bredasdorp Div.: Agulhas, *Schlechter*, 10557, ♂; Koude River, *Schlechter*, 9632, ♀.—Paarl Div.: French Hoek mountains, *Pickstone*, 20, ♀, 21, ♂, 22, ♀, 23, ♂.—Tulbagh Div.: Tulbagh Waterfall, *Ecklon and Zeyher*, ♂.—Clanwilliam Div.: Olifants River mountains, *Gill*, ♂.—Riversdale Div.: Albertinia, *Rogers*, 4107, ♂.—Mossel Bay Div.: hills near landing place at Mossel Bay, *Burchell*, 6290, ♀.

In various herbaria Nees von Esenbeck applied the following MS. names to plants of this species:—*Restio obtusiflorus*, *R. parviflorus*, var. *elongatus*, and *R. parviflorus*, var. *obtusiflorus*.

4. E. Muirii, *Pillans*, sp. nov.; culmis erectis teretibus supra medium ramosis; vaginis persistentibus erecto-patentibus ovato-oblongis obtusis vel acutis coriaceis purpureis; inflorescentia mascula dense paniculata cymosa; spathis vaginiformibus demum deciduis; bracteis erecto-patentibus ovato-lanceolatis hyalino-membranaceis; perianthio breviter stipitulato oblongo vel ovato; segmentis exterioribus ovato-lanceolatis membranaceis; segmentis interioribus oblongo-lanceolatis acutis cartilagineis exterioribus duplo longioribus; inflorescentia feminae spicatim cymosa; spathis persistentibus vaginiformibus erecto-patentibus purpureis; bracteis oblongis membranaceis apice obtusis; perianthio sessili oblongo; segmentis exterioribus lanceolato-oblongis membranaceis apice acutis; segmentis interioribus oblongis coriaceis apice rotundatis breviter acutis exterioribus brevioribus; ovario oblongo parum compresso; stylis tribus connatis supra medium distinctis.

Stems erect, stout, and rigid in their lower parts, moderately branched in the upper, terete, minutely cell-pitted, about 1 m. high, about 3 mm. in diameter at middle; branches 1–2 from each of the upper nodes, erect, simple or compound, slender and somewhat compressed; sheaths erect-spreading from shortly above their base, ovate-oblong, obtuse to acute, with a deciduous mucro, coriaceous, striate about the median nerve, pitted, purplish, mostly 1·3–1·8 cm. long; male inflorescence a dense panicle, oblong to lanceolate, 3–5 cm. long; spathes caducous, sheath-like; branches of the cymes several to many at each node of the rhachis, simple or compound, flexuous, reddish; bracts separated by about their own length, erect-spreading, ovate-lanceolate, acute, mucronate, hyaline-membranous, 1–2 mm. long; perianth shortly stipitate, oblong to ovate, 2·5–3 mm. long; outer segments ovate-lanceolate, acute, mucronulate, membranous; inner

segments oblong-lanceolate, acute, cartilaginous, twice as long as the outer ; female inflorescence spicate-cymose, oblong to linear-oblong, 5–7 cm. long ; spathes persistent, sheath-like, erect-spreading, purplish, mostly 2 cm. long ; branches of the cymes solitary, hidden by the spathes, 1–2-flowered ; bracts equalling the flowers in number, oblong, obtuse, mucronulate, hyaline-membranous, 7–8 mm. long ; perianth sessile, oblong, about 5 mm. long ; outer segments lanceolate-oblong, acute, membranous, pale ; the inner oblong, rounded at apex, abruptly acute, rigidly coriaceous, chestnut-brown, slightly shorter than the outer ; ovary oblong, somewhat compressed, soft in texture, reddish, surmounted by a hard chestnut-brown cap ; styles 3, united from their base about two-thirds of their length, forming a hard fluted column, erect and acuminate or recurved in their free parts.

South Africa : Cape Province—Riversdale Div. : Albertinia, *Muir*, 1354, ♂ and ♀ (type) ; near the coast, *Hortense Muir in Bolus Herb.*, 17827, ♀.

This very distinct species is named in honour of Dr. John Muir of Riversdale, who has during many years been carrying on, single-handed, a botanical survey of the Riversdale Division.

5. E. prominens, *Pillans*, sp. nov. ; culmis erectis ramosis gracilibus parum compressis paulo fistulosis ; vaginis persistentibus ad basem laxe convolutis supra medium expansis oblongo-lanceolatis acutis mucronatis cartilagineis ferrugineis ; inflorescentia feminea spicatim cymosa ; spathis laxe convolutis vaginis similibus ; floribus sessilibus et solitariis vel 2–3 in axillis spatharum breviter pedicellatis ; bracteis solitariis lanceolato-deltoideis membranaceis ; perianthio campanulato ; segmentis exterioribus minutis deltoideo-lanceolatis acutis ; segmentis interioribus ovato-oblongis subacutis membranaceis vel cartilagineis externis duplo longioribus ; ovario oblongo compresso perianthio superante superne solido et augustato ; stylis duobus liberis brevibus divergentibus.

Stems arising from creeping rhizomes, erect, sparingly or much branched, slender, somewhat compressed, minutely fistular, finely wrinkled, 3–5 dm. high, about 1 mm. in diameter ; sheaths loosely convolute at base, expanded towards the apex, oblong-lanceolate, acute, mucronate, cartilaginous, red-brown, yellow-speckled, paler at the margins, 1–1·5 cm. long ; female inflorescence spicate-cymose, 1·5–2·5 cm. long ; spathes conspicuous, hiding the spikelets, laxly convolute, oblong-lanceolate, acute, mucronate, cartilaginous, finely nervose, straw-coloured, red at apex, 1–1·5 cm. long ; flowers either sessile and solitary or 2–3 on short peduncles in the axil of each spathe ; bracts solitary lanceolate-deltoid, acute, membranous, mostly under 1 mm. long ; perianth campanulate, about 1 mm. long ; outer segments minute, deltoid-lanceolate, acute ; the inner ovate-oblong, subacute, membranous or cartilaginous, twice as long as the outer ; ovary at least

twice as long as the perianth, oblong, compressed, smooth, surmounted by a somewhat tapered and compressed cap which is slightly more than half as long as the ovary and has a distinct perpendicular fissure on two sides; styles 2, separated, divergent, short and adpressed.

South Africa: Cape Province—Cape Div.: sandy flats near west side of Zeekoe Vley, *Pillans*, 4139, ♀ (type); Belville, *White in Bolus Herb.*, 16187, ♀.

6. E. Neesii, *Mast. in Journ. Linn. Soc.*, x, 246 (1868)!: **Restio grandis,** var. β, *Nees in Linnaea*, v, 661 (1830)!; *Kunth, Enum.*, iii, 475 (1841): **Lamprocaulos Neesii,** *Mast. in DC. Monog. Phan.*, i, 350 (1878)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 517 (1895); *Mast. in Fl. Cap.*, vii, 115 (1897).

Stems caespitose or sporadic on creeping rhizomes, erect, sparingly branched, slender, terete or somewhat compressed in their upper parts, slightly fistular, minutely and closely rugose, golden brown when dry, 3–8 dm. high; sheaths closely convolute, oblong-lanceolate, acute, with a foliaceous mucro, cartilaginous, brown-membranous at the upper margins, with the texture and colour of the surface of the stems, mostly 2·5–5 cm. long; male inflorescence paniculate-cymose, laxly many-flowered, 4–6 cm. long; spathes conspicuous, erect-spreading, loosely convolute or flattened with the upper margins involute, oblong-lanceolate, acute, mucronate, cartilaginous, red-brown, with small golden raised cells, 3–5 cm. long; spikelets numerous on peduncles of varying length in the axils of the spathes, laxly 2–4-flowered, with the internodes often nearly equalling the flowers in length, 4–6 mm. long; bracts 1 or 2, linear-lanceolate, acute, membranous, 0·5–1 mm. long; perianth sessile, oblong or campanulate, 2·25–3·5 mm. long; segments membranous; the outer minute, linear-subulate, acute; the inner oblong-spathulate, more than twice as long as the outer; female inflorescence spicate-cymose, 3–5 cm. long; spathes as in the male but more erect and imbricate or convolute, 1·5–2·5 cm. long; spikelets hidden by the spathes, shortly peduncled, 1-flowered; bracts solitary, deltoid-lanceolate, acute, membranous, about 1·5 mm. long; perianth sessile, broadly oblong, 2–3·5 mm. long; segments membranous or cartilaginous; the outer lateral somewhat conduplicate or dorsally convex, linear-oblong, acute; inner segments oblong-spathulate, obtuse or subacute, distinctly exceeding the outer; ovary oblong, compressed, rough with raised epidermal cells, surmounted by a hard cap which is sometimes nearly half as long as the ovary; styles 2, arising from a stout stylopodium which protrudes beyond the perianth, divergent, recurved at apex, short.

South Africa: Cape Province—Cape Div.: Table Mt., *Burchell*, 569, ♂ and ♀, *Bolus*, 4441, ♂, *Pillans*, 4132, ♂ and ♀; depressions on mountains between Constantiaberg and Steenberg, *Pillans*, 4142, ♀; plateau on Karbonkel Berg, *Pillans*, 3953, ♂ and ♀; plateau on the Muizenberg, *Pillans*,

3410, ♂, 4133, ♂; Constantia, *Zeyher*, ♂ and ♀; Cape Flats, *Ecklon*, 560*b*, ♀. —STELLENBOSCH DIV.: flats at Stellenbosch, *Duthie*, ♀.—CALEDON DIV.: Viljoen's Pass, *Pillans*, 4809, ♂.

7. E. grandis, *Kunth, Enum.*, iii, 475 (1841)!, excl. var. β; [*Nees ex Drège in Linnaea*, xx, 243 (1847), nomen]; *Steud., Synops.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 245 (1868): **Restio grandis,** *Spreng. ex Nees in Linnaea*, v, 660 (1830)!, excl. var. β; *Nees, op. cit.*, vii, 617 (1832), excl. syn. *Willdenowia teres*: **Lamprocaulos grandis,** *Mast. in DC. Monog. Phan.*, i, 349, t. 3, figs. 22–28, t. 5, fig. 13 (1878)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 517 (1895); *Mast. in Fl. Cap.* vii, 115 (1897).

Stems erect, sparingly branched, terete, rigid, fistular, minutely pitted, reflecting a bronze sheen, 6–20 dm. high, 2–2·5 mm. in diameter at the middle; sheaths loosely convolute, often erect-spreading, oblong-lanceolate, subacute, mucronate, coriaceous, membranous at the upper margins, pitted, reflecting a golden sheen, 3–4 cm. long; male inflorescence paniculate-cymose, about 1 dm. long; spathes very conspicuous, erect-spreading, with the margins somewhat involute or flattened, oblong-lanceolate, acute, mucronate, cartilaginous, thinner at the margins, smooth on the inner surface, pitted and with a slight golden sheen on the outer, 5–7 cm. long; panicles laxly many-flowered, about half as long as the subtending spathe; bracts solitary below each flower, deltoid, acuminate, membranous, about 1 mm. long; perianth very shortly stipitate, oblong, 3·5–4 mm. long; segments hyaline-membranous; the outer lanceolate, acute; the inner oblong-lanceolate, acute, twice as long as the outer; female inflorescence spicate-cymose, linear-oblong, 8–12 cm. long; spathes erect, loosely convolute, sheath-like, 4·5–6 cm. long; spikelets 1–3 in the axil of each spathe, 1–2-flowered; bracts solitary below each flower, deltoid, subulate in the upper part, membranous, minute; perianth sessile, oblong, 5–5·5 mm. long; outer segments linear-oblong, acute, cartilaginous; the lateral somewhat navicular; inner segments oblong-spathulate, acute, cartilaginous, slightly exceeding the outer; ovary ovate-oblong, compressed, tubercled, blackish in dry material, exceeding the perianth; styles 2, arising at the angles of the ovary, short and stout.

South Africa: without precise locality, *Burchell*, ♀.

Cape Province—CAPE DIV.: Doornhoogte, Cape Flats, *Zeyher*, ♂ and ♀. —CALEDON DIV.: Houw Hoek, *Zeyher*, 4337, ♀; Genadendal, *Ecklon*, 34 partly, ♂ and ♀, *Zeyher*, ♂ and ♀.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 1650, ♂; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17669, ♂.

8. E. squamosa, *Mast. in Journ. Linn. Soc.*, x, 244 (1868)!, quoad pl. masc.; *in DC. Monog. Phan.*, i, 359 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v. 516 (1895); *Mast. in Fl. Cap.*, vii, 111 (1897): **E. pectinata,** *Pillans in Ann. Bolus Herb.*, iii, 145 (1922).

Stems erect, closely arranged, like the teeth of a comb, along creeping rhizomes, slender, simple, often slightly curved, terete, solid, wrinkled and pitted, 1–2 dm. high, 0·75–1 mm. in diam. at the middle; sheaths subpersistent on the lower parts of the stems, deciduous on the upper, loosely convolute, oblong, acute to obtuse, mucronate, coriaceous, chestnut-brown, chartaceous and paler at apex and margins, striate on the upper half, 1–1·5 cm. long; male inflorescence paniculate-cymose, oblong, densely many-flowered, mostly 1–2 cm. long; spathes caducous, lanceolate-oblong, acute, mucronulate, cartilaginous, chestnut-brown; the lower 1–1·5 cm. long; spathellae minute, membranous; spikelets oblong, with 2 flowers or transversely trigonous with 3 flowers, 3–3·5 mm. long; bracts ovate, obtuse, hyaline-membranous, 1·5 mm. long; perianth oblong, subterete, 2·75–3 mm. long; outer segments oblong-ovate, acute, membranous, with a prominent midrib; inner segments oblong, subacute, cartilaginous, twice as long as the outer; female inflorescence spicate-cymose, linear-oblong, few-flowered, 1–2 cm. long; spathes persisting during the flowering period, sheath-like but smaller; spathellae minute or absent; spikelets obliquely oblong, 1–2-flowered, 2·5–3·5 mm. long; bracts deltoid, acute, membranous, with a rigid midrib, 1·5–2 mm. long; perianth oblong, trigonous, 2–2·5 mm. long; outer segments oblong, acute, cartilaginous; the lateral navicular, carinate; the anterior with a prominent midrib; inner segments ovate-oblong, subacute, cartilaginous, equalling the outer; ovary pyriform; styles 3.

South Africa: Cape Province—Cape Div.: on dry clay slopes, Lion's Head, *Pappe*, 105, ♂; on clay, lower north slopes of Devil's Peak, *Wilms*, 3807, ♂, *Pillans*, 3401, ♂ and ♀; lower slopes above Oude Kraal, *Pillans*, 3403, ♂ and ♀.—Caledon Div.: Zwartberg, above Caledon, *L. Guthrie in Bolus Herb.*, 16016, ♂.—Stellenbosch Div.: clay slopes, Sir Lowry's Pass, *L. Guthrie in Bolus Herb.*, 16622, ♀, *Duthie*, 1488, ♂; first river terrace at Stellenbosch, *Duthie in University of Stellenbosch Herb.*, 1634.

9. E. Verreauxii, *Mast. in Journ. Linn. Soc.*, xxi, 589 (1885)!; *in Fl. Cap.*, vii, 114 (1897).

Stems in small tufts on creeping rhizomes, erect, slender, simple, 1–2·5 dm. high, 0·75 mm. in diameter; sheaths persisting during the flowering period or longer, expanded or loosely convolute, oblong to ovate-oblong, obtuse to acute, with a slender mucro, coriaceous, more or less nervose-striate, 7–10 mm. long; male inflorescence spicate-cymose, linear to oblong, rarely conical, usually compact, many-flowered, mostly 1–2·5 cm. long; spathes caducous, sheath-like but smaller; spathellae inconspicuous, hyaline-membranous; spikelets oblong, slightly compressed, 3–4-flowered, 3–4 mm. long; bracts oblong, acute, mucronate, membranous, 2 mm. long; perianth linear-oblong, subtrigonous, compressed, 2·5 mm. long; outer

segments lanceolate, acute, mucronate, membranous; the lateral with a prominent midrib; inner segments linear-oblong, acute, mucronulate, with involute margins, subcartilaginous, shortly exceeding the outer; female inflorescence resembling the male but shorter and broader, fewer-flowered and usually interrupted in its lower part, mostly 1–2 cm. long, occasionally only 5 mm.; spathes falling soon after the flowering period, resembling those of the male; spathellae minute, membranous; spikelets oblong, 2-flowered, 4 mm. long; bracts oblong, obtuse, mucronulate, membranous, with a rigid midrib, 1·5–2 mm. long; perianth subterete, flattened on its inner side, linear-oblong, 2·5–3 mm. long; outer segments lanceolate, acute, mucronulate, membranous; the lateral obsoletely carinate; inner segments lanceolate-ovate, acute mucronulate, abruptly narrowed at base, thinly cartilaginous, shortly exceeding the outer; ovary obtusely 3-angled in its lower part, finely wrinkled; styles 3.

South Africa: without precise locality, *Ludwig*, ♀, *Verreaux in Herb. Mus. Brit.*, ♀, *Zeyher*, ♂ and ♀.

Cape Province—Cape Div.: depressions on Claremont Flats, *Schlechter*, 1538, ♂; Fish Hoek Valley, *Wolley-Dod*, 3361, ♀, *Pillans*, 3399, ♂ and ♀.—Stellenbosch Div.: slopes near Sir Lowry's Pass, *MacOwan*, 1790, ♂; flats near the Strand, *Pillans in Bolus Herb.*, 18441, ♂ and ♀.—Malmesbury Div.: Theefontein, *Bachmann*, 1771, 1772.

10. E. vaginulata, *Mast. in Journ. Linn. Soc.*, xxi, 586 (1885)!; *Durand et Schinz, Consp. Fl. Afr.*, 516 (1895); *Mast. in Fl. Cap.*, vii, 111 (1897).

Stems sporadic or regular (like the teeth of a comb) on creeping rhizomes, erect, simple or rarely with a few barren branchlets, terete, solid, finely wrinkled, 2–4 dm. high, about 1 mm. in diameter; sheaths caducous, lanceolate to oblong-lanceolate, obtuse, mucronate, coriaceous, chartaceous at apex, nervose-striate on the upper parts, 1·2–2 cm. long; male inflorescence spicate-cymose, oblong to linear-oblong, densely many-flowered or interrupted in the lower part, 1·5–2·5 cm. long; spathes persistent, sheath-like, the lower about 1·2 cm. long; spathellae inconspicuous, oblong-lanceolate, membranous, the larger about 2·5 mm. long; spikelets broadly ovate to orbicular, compressed, 3–4-flowered, about 2·5 mm. long; bracts orbicular, with a prominent midrib, membranous, 1–1·25 mm. long; perianth oblong, obtusely trigonous, 1·75–2 mm. long; outer segments oblong, obtuse, cartilaginous; the lateral carinate; the anterior with a prominent midrib; inner segments oblong, obtuse, cartilaginous, scarcely twice as long as the outer; female inflorescence resembling the male; spathellae minute; spikelets compressed, broadly ovate, 2–4-flowered, 2·5–4 mm. long; bracts closely convolute, broadly ovate, obtuse, slightly keeled, membranous, 1·25–1·5 mm. long; perianth ovate to oblong-ovate, trigonous, 1·5–2·75 mm. long; outer segments navicular carinate, lanceo-

late-oblong, subacute or obtuse, cartilaginous; inner segments oblong, obtuse, with the midrib prominent on the upper half, cartilaginous, subequal or equal with the outer; ovary ovate, slightly compressed, reddish, yellow at apex; styles 3, stout, reflexed.

South Africa: Cape Province—Cape Div.: Red Hill, *Bolus*, 17065, ♂; hills west of Simon's Town, *Pillans*, 3398, ♂ and ♀; plateau on the Muizenberg, *Pillans*, 4137, ♂ and ♀.—Stellenbosch Div.: flats at Mulder's Vley, *Duthie*, 965, ♂.—Ceres Div.: mountain slopes near Ceres, *Bolus*, 5480, ♀.—Riversdale Div.: base of Lange Bergen, near Kampsche Berg, *Burchell*, 7141, ♂, *Muir*, 3207, ♂, 3208, ♀.—Uitenhage Div.: Van Staden's Berg, *Zeyher in Herb. Mus. Austr.-Afr.*, 12971, ♂.—Port Elizabeth Div.: Walmer, *Paterson*, 2360, ♂ and ♀.

11. E. parviflora, *Kunth, Enum.*, iii, 467 (1841) !, excl. syn. omn.; *Drège, Zwei Pfl. Documente*, 82, 101, 128 (1844); *Steud., Synops. Pl.*, ii, 262 (1855), excl. syn. *R. parviflorus*; *Mast. in Journ. Linn. Soc.*, x, 244 (1868), excl. syn. *R. parviflorus*; *in DC. Monog. Phan.*, i, 353 (1878), excl. syn. *R. parviflorus, Thunb.*; *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895), excl. syn. *R. parviflorus, Thunb.*; *Mast. in Fl. Cap.*, vii, 113 (1897), excl. syn. *R. parviflorus, Thunb.*: **E. propinqua,** *Kunth*, forma minor, *Mast. in Journ. Linn. Soc.*, xxi, 582 (1885) !; *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895): **E. obtusiflora,** *Mast. in Fl. Cap.*, vii, 112 (1897) !: **E. gracilis,** *N. E. Br. in Fl. Cap.*, vii, 754 (1900) !: **E. Rehmannii,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 7 (1900) !.

Stems caespitose, erect, slender, simple or rarely slightly branched (but then the branches are usually barren), terete, solid or fistular, wrinkled, puncticulate, 2–6 dm. high, 0·5–1 mm. in diameter at the middle; sheaths caducous, linear-oblong, obtuse or subacute, mucronate, coriaceous, chartaceous and nervose in their upper parts, red-brown, 1·5–3·5 cm. long; male inflorescence paniculate-cymose, linear to oblong, densely many-flowered, mostly 3–5 cm. long; spathes persistent, expanded, lanceolate to oblong, acute or acuminate, chartaceous, nervose, red-brown to horn-coloured, 1–2·5 cm. long; spathellae inconspicuous, linear-lanceolate, chartaceous, the larger 4–5 mm. long; spikelets ovate to oblong, 3–8-flowered, 2–3 mm. long; bracts closely convolute, ovate, obtuse, muticous or mucronulate, membranous, red-brown, 1–1·25 mm. long; flowers secund; perianth broadly ovate, obtuse, 1·25–1·75 mm. long; outer segments oblong, obtuse, membranous; the lateral somewhat navicular, slightly carinate; inner segments oblong, obtuse, rather incurved at the apex, membranous, scarcely twice as long as the outer; female inflorescence spicate-cymose, oblong to linear-oblong, many-flowered, 2–4 cm. long; spathes persistent, loosely convolute or expanded, oblong to oblong-lanceolate, acute or acuminate, thinly coriaceous or chartaceous, membranous at the margins,

nervose, 1–1·5 cm. long, 4–6 mm. in diameter; spathellae inconspicuous or absent; spikelets few, partly or entirely hidden by the spathes, oblong, ovate or rounded, more or less compressed, 4–8-flowered, 3–4 mm. long; bracts ovate to ovate-lanceolate, acute to obtuse, mucronulate, submembranous, reddish, 1–1·5 mm. long; perianth trigonous, ovate to oblong, 1·5 mm. long; outer segments oblong, obtuse, cartilaginous, more or less carinate; the lateral navicular, occasionally with a narrow wing on the dorsal angle; inner segments oblong, obtuse, cartilaginous, equalling or slightly exceeding the outer; ovary obovoid, with lateral ridges; styles 3.

South Africa : without precise locality, *Thunberg*, ♀, *Banks*, ♀, *Thom*, ♀, *Wallich*, ♂, *Verreaux*, ♂, *Zeyher*, 1739, ♂, 9455, ♂, *Reichenbach*, ♂, *Bachmann*, 1760, ♂.

Cape Province—Cape Div.: Lion's Head, *Pappe in Herb. Mus. Austr.-Afr.*, 12974, ♂; Table Mt., *Guthrie*, 1451, ♂; Cape Flats, near Rondebosch, *Burchell*, 822, ♂, *Bolus*, 4432, ♂; between Wynberg and Devil's Peak, *Drège*, 150, ♂; Cape Flats between Claremont and Muizenberg, *Rehmann*, 1805, ♂, 1806, ♂, *Wolley-Dod*, 2574, ♂, *Schlechter*, 301, ♂, 7542, ♀, *Pillans*, 3397, ♂ and ♀; plateau on the Muizenberg, *Pillans*, 4136, ♂ and ♀, 4138, ♀, 4369, ♂ and ♀, *Moss*, 7841, ♂; Klaver Vley, *Moss*, 7863, ♂ and ♀; Kirstenbosch, *Page in Bolus Herb.*, 15870, ♂ and ♀; plateau south-west of Buffels Bay, *Pillans*, 4367, ♂ and ♀; "False Bay," *Robertson*, ♂.—Malmesbury Div.: mountains near Saron, *Schlechter*, 10657, ♂.—Stellenbosch Div.: Kraaifontein, *Marloth*, 3177, ♂.—Caledon Div.: Hottentots Holland Mts., *Pappe in Herb. Mus. Austr.-Afr.*, 12973, ♂; Donkerhoek and Ezelsjagt Mts., *Drège*, 118, ♀; Houwhoek, *Galpin*, 4800, ♂; Zwartberg, *Pappe in Herb. Mus. Austr.-Afr.*, 12840, ♂, *O. Kuntze*, ♀; Babylons Tower, *Guthrie in Bolus Herb.*, 16186, ♂; Hermanus, *Burtt-Davy*, 18623, ♀, *Guthrie in Bolus Herb.*, 17628, ♀; Genadendal, *Drège*, 1638, ♂.—Paarl Div.: Klein Drakenstein Mts., *Drège*, 1646, ♂.—Tulbagh Div.: near Tulbagh Waterfall, *Ecklon and Zeyher*, ♂ and ♀; Sneuwgat, Great Winterhoek, *Phillips*, 1688, ♂ and ♀; Witsenberg, *Burchell*, 8647, ♀.—Ceres Div.: slopes of Matroosberg, *Marloth*, 2229, ♂.—Worcester Div.: mountains above Worcester, *Rehmann*, 2565, ♀; Du Toit's Kloof, *Drège*, 120, ♂ and ♀, 1649, ♂.—Clanwilliam Div.: base of Sneuwkop, *Wallich*, ♀; sandy flats near Ezelsbank, Cedar Berg, *Drège*, 2519, ♀.—Laingsburg Div.: Witteberg, *Compton*, 2756, ♂, *in Bolus Herb.*, 18314, ♀.—Riversdale Div.: Garcia's Pass, *Galpin*, 4805, ♂ and ♀.—George Div.: Montagu Pass, *Schlechter*, 2288, ♀; Cradock Berg, *Galpin*, 4804, ♂, 4806, ♂.—Uniondale Div.: headwaters of Wagenbooms River, *Fourcade*, 2346, ♂ and ♀.—Uitenhage Div.: between Van Staden's Berg and Bethelsdorp, *Drège*, 9455, ♂.—Port Elizabeth Div.: without precise locality, *E. S. C. A. Herb.*, 254, ♂.

Var. β, filacea (*Pillans*): **E. filacea,** *Mast. in Journ. Linn. Soc.*, xxi, 589

(1885) ! ; *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895) ; *Mast. in Fl. Cap.*, vii, 112 (1897) ; *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900) : stems very slender, subfiliform ; male inflorescence mostly 1·5–2 cm. long ; female inflorescence 1–2 cm. long ; perianth 1–1·25 mm. long.

South Africa : without precise locality, *Drège*, 110, ♂.

Cape Province—Caledon Div. : Sir Lowry's Pass, *Drège*, 126, ♀ ; Houwhoek, *Burchell*, 8121, ♀ ; Koude River, *Schlechter*, 9629, ♂, 9630, ♀.

Var. γ, rigida (*Pillans*) : **E. rigida,** *Mast. in Journ. Linn. Soc.*, xxi, 587 (1885) ! ; *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895) ; *Mast. in Fl. Cap.*, vii, 113 (1897) : **E. parviflora,** *Kunth, Enum.*, iii, 469, formae 1 et 6 (1841) ! : female inflorescence linear, compact, 2·5–4 cm. long ; spathes chartaceous, pale ; spikelets hidden by the spathes, 2–3-flowered.

South Africa : without precise locality, *Drège*, 111, ♀.

Cape Province—Paarl Div. : Drakenstein Mts., *Drège*, 121, ♂ and ♀ ; near Bain's Kloof, *Bolus*, 4100, ♂ and ♀.—Tulbagh Div. : Tulbagh Kloof, *MacOwan*, 1675, ♂ and ♀, 2069, ♂ and ♀, *Zeyher*, ♀.—Worcester Div. : Du Toit's Kloof, *Drège*, 1639, ♀.

12. E. spathacea, *Mast. in Journ. Linn. Soc.*, xxi, 588 (1885) ! ; *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895) ; *Mast. in Fl. Cap.*, vii, 113 (1897).

Stems caespitose, erect, slender, simple, wrinkled, 3–4 dm. high, 1–1·25 mm. in diameter at the middle ; sheaths caducous, oblong-lanceolate, acute, mucronate, coriaceous, nervose-striate, 2–2·5 cm. long ; male inflorescence paniculate-cymose, linear-oblong, densely or rather laxly many-flowered, 3·5–5 cm. long ; spathes persistent, expanded, lanceolate-oblong, acute, mucronulate, chartaceous, the lower 1·8–2·5 cm. long, about 6 mm. broad ; spathellae linear-lanceolate, acuminate, membranous, 2–3 mm. long ; spikelets ovate or conical, 4–5-flowered, 2·5–3 mm. long ; bracts ovate, obtuse, membranous, 1 mm. long ; flowers secund ; perianth oblong, flattened on the inner side, rounded on the outer, 1·5 mm. long ; outer segments oblong, obtuse, membranous ; the lateral with a midrib slightly raised ; inner segments oblong, obtuse, membranous, distinctly broader than and scarcely twice as long as the outer ; female inflorescence spicate-cymose, lanceolate to oblong-lanceolate, somewhat compressed, many-flowered, 2·5–6 cm. long ; spathes persistent, lanceolate to ovate-lanceolate, acute, mucronulate, expanded, subcoriaceous, chartaceous at the apex and margins, red-brown, the lower 1·5–3 cm. long, 7–10 mm. in diameter ; spathellae as in the male, but with a rigid midrib, 3·5–5 mm. long ; spikelets entirely hidden by the spathes, oblong, 4–5-flowered, 3–4 mm. long ; bracts broadly ovate, obtuse, membranous, with a prominent midrib, 1–1·5 mm. long ; perianth trigonous, oblong, 1·5 mm. long ; outer segments oblong, obtuse, or subacute, slightly keeled, cartilaginous ; inner segments ovate-

oblong, obtuse, cartilaginous, equalling the outer; ovary oblong, somewhat compressed, with an inconspicuous ridge on either side; styles 3.

South Africa: Cape Province—Stellenbosch Div.: near Stellenbosch, *Garside*, 1214, ♀.—Caledon Div.: Donkerhoek Mt., *Burchell*, 7959, ♀; tops of the mountains at Baviaans Kloof, near Genadendal, *Burchell*, 7710, ♂ and ♀; Houwhoek, *Burchell*, 8066, ♂ and ♀, *Schlechter*, 7578, ♂, 7579, ♀; Grabouw, *Pillans*, 4806, ♂ and ♀.—Worcester Div.: Onklaarberg, *Stokoe*, 1213*a*, ♂, 1213*b*, ♀.

Var. β, attenuata (*Pillans*), female inflorescence linear, 8–10 cm. long; spikelets 2–3-flowered; perianth up to 1·75 mm. long.

South Africa: Cape Province—Tulbagh Div.: near Tulbagh Waterfall, *Schlechter*, 7457, ♂, 7458, ♀.

13. E. fastigiata, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 7 (1900) !.

Stems caespitose, erect, simple, terete, obsoletely puncticulate, 2–5 dm. high, 1 mm. in diameter at middle; sheaths caducous, lanceolate, acute, coriaceous in their lower half, chartaceous in their upper, light brown or straw-colour in the upper half, 2–2·8 cm. long; male inflorescence paniculate-cymose, oblong to linear-oblong, densely many-flowered, mostly 2·5–4 cm. long; spathes persistent, expanded, oblong-lanceolate, acute, with a scabrid awn, chartaceous, about 2 cm. long; spathellae conspicuous, linear-lanceolate, acuminate, with scabrid awns, cartilaginous, pale, mostly 8–10 mm. long with the awn; spikelets ovate, compactly 3–4-flowered, 2–2·5 mm. long; bracts loosely convolute, linear-lanceolate, acuminate, with scabrid awns, membranous, mostly 4–6 mm. long, including the awn; perianth subterete, ovate-oblong, 1·5 mm. long; outer segments oblong-lanceolate, acute, mucronulate, membranous; inner segments spathulate-oblong, obtuse, mucronulate, about twice as long as the outer; female inflorescence resembling the male but more compact and with the spikelets hidden by the spathes; spathes as in the male but imbricate and convolute; spathellae lanceolate with a prominent midrib which is excurrent in a scabrid awn, cartilaginous, pale, mostly 1–1·2 cm. long, including the awn; spikelets 2–6-flowered, 3–4 mm. long; bracts linear-lanceolate, aristate, membranous, with a rigid midrib, dorsally scabrid, mostly 5–8 mm. long; perianth ovate-oblong, trigonous, 1·75–2 mm. long; outer segments linear-oblong, obtuse, mucronulate, cartilaginous, membranous at the margins; the lateral navicular; inner segments spathulate-oblong, obtuse, mucronulate, membranous, equalling the outer; ovary ovate, acute at the apex, sharply 3-angled, smooth and shiny; styles 3.

South Africa: Cape Province—Ceres Div.: Mitchell's Pass, *Schlechter*, 9954, ♂, 9955, ♀.

14. E. asperiflora, *Kunth, Enum.*, iii, 474 (1841) !; *Nees ex Drège in*

Linnaea, xx, 243 (1847); *Steud., Synops. Pl.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 244 (1868); *in DC. Monog. Phan.*, i, 355, tab. 3, figs. 29–32, tab. 5, fig. 14 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 110 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900): **Restio asperiflorus,** *Nees in Linnaea*, v, 656 (1830)!: **E. Drègeana** *Kunth, Enum.*, iii, 469 (1841)!; *Drège, Zwei Pfl. Documente*, 122 (1844); *Steud., Synops. Pl.*, ii, 262: **E. ciliata,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 8 (1900)!.

Stems caespitose, erect, simple, terete at base, elsewhere more or less compressed, wrinkled, puncticulate, pale green, 5–8 dm. high, about 2 mm. in diameter at the middle; sheaths on the middle and upper parts of the stems 1 or 2, rarely 3, remote, persistent, closely convolute or occasionally loose at the apex, linear-lanceolate, acute, subulate-mucronate or aristate, coriaceous, membranous at their margins, more or less striate, puncticulate, 3–10 cm. long; male inflorescence paniculate-cymose, elongate-ovate to linear-oblong, dense, 3–5 cm. long; spathes persistent, erect-spreading, lanceolate, acute, with the median nerve excurrent in a slender mucro; the lower convolute and chartaceous, 3–5 cm. long; the upper expanded, hyaline-membranous, striate, pale to reddish brown; spathellae usually conspicuous, resembling the upper spathes; spikelets very numerous, in panicled cymes, many-flowered, ovate to oblong, dense, 3–4·5 mm. long; bracts closely convolute, ovate, acute, with an erect-spreading awn, membranous to cartilaginous, finely lacerate and hyaline at the margins, serrulate on the midrib, 1·5 mm. long; perianth ovate to oblong, compressed, 1·5–2 mm. long; outer segments lanceolate, acute, mucronate, membranous or cartilaginous, lacerate-ciliate and membranous at the margins, minutely scabrid on the dorsal surface; the lateral somewhat carinate, serrulate on the midrib; inner segments oblong, acute, mucronulate, membranous, hyaline and finely lacerate at the upper margins, minutely scabrid on the dorsal surface, often serrulate on the upper half of the midrib, shortly or distinctly exceeding the outer; female inflorescence resembling the male; spathes and spathellae as in the male; spikelets compressed, ovate to roundish, about 8-flowered, 6–7 mm. long; bracts closely convolute, oblong to oblong-lanceolate, acute, aristate, obtusely carinate, cartilaginous, dorsally minutely scabrid, often serrulate on the apical half of the midrib, finely lacerate and hyaline at the margins, 2–3 mm. long; perianth sessile, triquetrous, oblong, about equal with the subtending bract; outer segments lanceolate, acute, mucronate, cartilaginous, membranous at margins, dorsally minutely scabrid, serrulate on the upper half of the midrib; inner segments oblong, acute, mucronulate, hyaline-cartilaginous, finely lacerate-ciliate, equalling or shortly longer than the outer; ovary triquetrous; styles 3, adjacent; nut triquetrous, smooth, shiny, purple-brown.

South Africa : without precise locality, *Drège*, 106, ♂, 107, ♀, *Harvey*, 391, ♂, *Thom*, ♀.

Cape Province—Cape Div. : Constantia, *Ecklon and Zeyher*, ♂ and ♀; Lion's Head, *Pappe in Herb. Mus. Austr.-Afr.*, 12963, ♂; Cape Flats, *Ecklon and Zeyher in Herb. Mus. Austr.-Afr.*, 12861, ♂, *Page in Bolus Herb.*, 16998, ♀; base of the Steenberg, *Wolley-Dod*, 3618, ♂; plateau on the Steenberg, *Pillans*, 4368, ♂ and ♀; plateau on the Muizenberg, *Pillans*, 4372, ♂. —Caledon Div. : Houwhoek, *Burchell*, 8057, ♀, 8140, ♂ and ♀, *Drège*, 1641, ♂, *Galpin*, 4801, ♂; Steenbras, *Rogers*, ♂; Palmiet River, near Grabouw, *Bolus*, 4223, ♂; Grietjesgat, *Bolus*, 4221, ♀; Vogelgat, *Schlechter*, 9571, ♂, 9572, ♀, *Bolus*, 16996, ♂.—Tulbagh Div. : Tulbagh Waterfall, *Ecklon and Zeyher*, ♂.—Ceres Div. : Mitchell's Pass, *Bolus*, 9665, ♀.—Worcester Div. : Du Toit's Kloof, *Drège*, 1640, ♀; mountains north of Worcester, *Rehmann*, 2563, ♂, 2564, ♀.—Calvinia Div. : Roodeberg and Ezelskop, *Drège*, 2518, ♂.—Riversdale Div. : between Vet River and Krombeks River, *Burchell*, 7179, ♂ and ♀; by streams near Riversdale, *Schlechter*, 1943, ♀.—Humansdorp Div. : Clarkson, *Schlechter*, 6017, ♀, 6019, ♂, *Fourcade*, 2434, ♂ and ♀.—Uniondale Div. : between Welgelegen and Onzer, *Drège*, 102, ♂.—Bathurst Div. : near Port Alfred, *Burchell*, 3996 partly, ♂.

Var. β, lacerata (*Pillans*) : **E. lacerata,** *Pillans in Ann. Bolus Herb.*, iii, 144 (1922) : sheaths loosely convolute or the lower expanded ; bracts and perianth-segments in both sexes with conspicuously lacerate margins.

South Africa : Cape Province—Worcester Div. : Du Toit's Kloof, *Bolus*, 16997, ♂.—Prince Albert Div. : Zwartberg Pass, *Bolus*, 11661, ♂. —Albany Div. : stony hills near Graham's Town, *MacOwan*, 1360, ♂, 1359, ♀.—King William's Town Div. : summit of Perie Mt., *Galpin*, 5944, ♂.—Stutterheim Div. : Dohne Hill, *Sim*, 2843, ♂.

15. E. coleura, *Nees ex Mast. in DC. Monog. Phan.*, i, 358 (1878) ! ; *in Journ. Linn. Soc.*, xxi, 586 (1885) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895) ; *Mast. in Fl. Cap.*, vii, 106 (1897) ; *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900) : **E. exilis,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 7 (1900) !.

Stems sporadic on creeping rhizomes, erect, simple or sparingly branched in their lower parts, terete at base, elsewhere compressed, somewhat wrinkled, with silvery iridescence, 3–7 dm. high, about 1·5 mm. in diameter at middle ; sheaths mostly persisting during the flowering period, loosely convolute or flattened and erect-spreading, oblong-lanceolate, acute, mucronate, coriaceous, membranous at margins, faintly striate, purple-spotted, 2·5–3·5 cm. long ; male inflorescence paniculate-cymose, lax and interrupted or dense and compact, mostly 3–6 cm. long ; spathes persisting during the flowering period, sheath-like but smaller ; spathellae conspicuous, linear-

lanceolate, acuminate, chartaceous or membranous, with a prominent midrib; spikelets very numerous, ovate, 3–5-flowered, 2·5–3 mm. long; bracts ovate, obtuse, mucronulate, cartilaginous, hyaline at margins, 1·5 mm. long; perianth sessile, ovate to oblong, about 1·75 mm. long; segments oblong, acute, thinly cartilaginous; the outer lateral slightly carinate; the inner about twice as long as the outer; female inflorescence at first cylindric, becoming linear-oblong, 2–4 cm. long; spathes as in the male but convolute or with the upper half expanded; spathellae equalling or exceeding the spikelets, hyaline-cartilaginous; spikelets mostly hidden by the spathes, oblong, 1–2 flowered, about 3 mm. long; bracts oblong-ovate, obtuse, mucronulate, hyaline-cartilaginous, about 2 mm. long; perianth oblong, about 2·5 mm. long; outer segments ovate, rounded and finely lacerate at the apex, hyaline-cartilaginous; the lateral obtusely carinate; inner segments ovate, rounded and somewhat emarginate at apex, finely lacerate at the margins, hyaline-cartilaginous, slightly exceeding the outer; ovary oblong; styles 3, occasionally 2, adjacent at base.

South Africa: Cape Province—Cape Div.: Table Mt., *Burchell*, 571, ♂; flats near Rondebosch, *Burchell*, 168, ♂; Kenilworth, *O. Kuntze*, ♀; Doornhoogte, *Ecklon and Zeyher in Herb. Mus. Austr.-Afr.*, 12958, ♂; flats east of Kenilworth Racecourse, *Bolus*, 15677, ♂.—Stellenbosch Div.: flats at Stellenbosch, *Garside*, 1189, ♂ and ♀.—Paarl Div.: Berg River in Klein Drakenstein, *Drège*, 1648, ♂.—Caledon Div.: River Zonder Einde, *Schlechter*, 9893, ♂, 9894, ♀; Hottentots Holland, *Zeyher*, ♂.—Tulbagh Div.: Tulbagh Kloof, *Ecklon and Zeyher*, ♂.—Ceres Div.: Mitchell's Pass, *Bolus*, 9664, ♂.—Worcester Div.: mountains above Worcester, *Rehmann*, 2565, ♀, 2570, ♂, 2571, ♀.—Humansdorp Div.: Clarkson, *Penther*, 389, ♂.

This is the *Restio coleurus*, Nees, MSS. in herbaria.

16. E. glauca, *Mast. in Journ. Linn. Soc.*, xxi, 579 (1885)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 107 (1897).

Stems erect, simple, stout or rather slender (but then accompanied by some that are barren), terete, rugose, pale green, 5–10 dm. high, mostly about 4 mm. in diameter at the middle; sheaths usually persisting during the flowering period, loosely convolute or erect-spreading, expanded, lanceolate to linear-lanceolate, acute, subulate-mucronate, coriaceous, chartaceous in the upper parts, membranous at the margins, dorsally rugulose, obsoletely striate, light brown, mostly 5–7 cm. long; male inflorescence paniculate-cymose, densely many-flowered, linear to oblong, mostly 4–6 cm. long; spathes conspicuous, subpersistent, erect-spreading, expanded; the lower sheath-like, 4–5 cm. long; the middle and upper chartaceous, smaller; spathellae lanceolate, acuminate, aristate, membranous, the larger 5–8 mm. long; spikelets densely clustered, ovate to

oblong, 6–8-flowered, 3–4 mm. long; bracts closely convolute, ovate, acute, aristate, cartilaginous, membranous at the margins, ciliolate, dorsally scabrid, 1·25–1·5 mm. long; perianth compressed, oblong, 1·75–2 mm. long; outer segments oblong-ovate, acute, mucronulate, cartilaginous, ciliolate, dorsally scabrid; the lateral slightly carinate; inner segments oblong, acute, mucronulate, ciliolate on their upper margins, membranous, scabrid on their upper parts, twice as long as the outer; female inflorescence paniculate-cymose, compact or interrupted in the lower part, narrow-oblong, densely many-flowered, mostly 4–9 cm. long; spathes persistent, erect-spreading, expanded; the lower sheath-like, 4–5 cm. long; the upper chartaceous, smaller; spathellae usually conspicuous, resembling the uppermost spathes; spikelets crowded, cuneate to oblong, containing 2–7 perfect flowers, 3–8 mm. long (excluding awns); bracts ovate to oblong, acute to acuminate, aristate, cartilaginous, membranous and ciliolate at the margins, dorsally rugulose, 3–5 mm. long; flowers trigonous, oblong, 2 mm. long; outer segments ovate-oblong, acute, mucronulate, slightly carinate, submembranous, dorsally scabrid, sparsely ciliolate; inner segments spathulate-oblong, acute, mucronulate, sparsely ciliolate, membranous, dorsally scabrid, equalling or slightly exceeding the outer; ovary triquetrous; styles 3, adjacent at base, short and slender; fruit sharply triquetrous, smooth, shiny, black.

South Africa: Cape Province—Caledon Div.: mountains near Grietje's Gat, *Bolus*, 4221, ♀.—Tulbagh Div.: Sneuwgat, Great Winterhoek Mt., *Phillips*, 1689, ♀.—Ceres Div.: Matroosberg, *Marloth*, 10157, ♀; near Laaken Vley, Matroosberg, *Phillips in Herb. Mus. Austr.-Afr.*, 11108, ♂ and ♀.—Worcester Div.: mountains above Worcester, *Rehmann*, 2564, ♀.—Riversdale Div.: summit of Kampscheberg, *Burchell*, 7105, ♂ and ♀.

This is the *Restio glaucus*, Burchell, MSS. in his herbarium !.

17. E. intermedia, *Pillans*, comb. nov.: **Restio intermedius,** *Steud. in Flora*, 1829, i, 132 !: **R. membranaceus,** *Nees in Linnaea*, v, 657 (1830) !; *op. cit.*, vii, 617 (1832): **Elegia membranacea,** *Kunth, Enum.*, iii, 474 (1841) !; *Steud., Synops.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 247 (1868); *op. cit.*, xxi, 581 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 108 (1897).

Stems caespitose, erect, simple, rather slender, solid, terete, faintly wrinkled, grey-green, with a slight silver iridescence, 4–6 dm. high, 1·5–2 mm. in diameter at the middle; sheaths persisting during the flowering period or longer, loosely convolute, linear-lanceolate, acute, with the midrib excurrent as a mucro, chartaceous, smooth, buff coloured, densely spotted and streaked with red-brown, 6–9 cm. long; male inflorescence linear-oblong, composed of loosely panicled cymes, 3–7 cm. long; spathes persisting during the flowering period or longer, expanded, lanceolate, acute, aristate,

texture and colouring as in the sheaths, 4–6 cm. long; spathellae ovate at base, long-attenuate upwards, aristate, membranous; spikelets laxly 2–3-flowered; bracts loosely convolute, deltoid-ovate, mucronate, membranous, about 2 mm. long; perianth oblong, 2·75–3 mm. long; segments oblong, acute, mucronulate, cartilaginous; the outer faintly keeled, half or slightly more than half the length of the inner; female inflorescence spicate-cymose, compact, linear-oblong, 4–5 cm. long; spikelets partly hidden by the spathes, ovate or orbicular, 2–4-flowered, 3–3·5 mm. long; spathes as in the male but inclined to imbricate; spathellae and bracts as in the male; perianth sessile, oblong, 2 mm. long; segments oblong, acute, mucronate or mucronulate, cartilaginous, thinner at the margins, equal or subequal; styles 3, distinct at base; fruit oblong-pyriform, obscurely trigonous, black and shining.

South Africa : Cape Province—Cape Div. : upper plateau on Table Mt., *Burchell*, 564, ♂ and ♀, *Berg*, ♂, *Ecklon*, 836, ♂, *Harvey*, 200, ♂, *Marloth*, 3121, ♂, 3196, ♂, *Pillans*, 3952, ♂ and ♀.

18. E. fistulosa, *Kunth, Enum.*, iii, 467 (1841)!; *Drège, Zwei Pfl. Documente*, 85 (1844); *Steud., Synops. Pl.*, ii, 261 (1855); *Mast. in Journ. Linn. Soc.*, x, 243 (1868); *in DC. Monog. Phan.*, i, 356 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895); *Mast. in Fl. Cap.*, vii, 110 (1897).

Stems caespitose, erect, simple, terete, fistular, easily bent, scabrid and brown at base, smooth or slightly wrinkled and grey-green above, 6–9 dm. high, 1·5–2·25 mm. in diameter at middle; internodes commonly 1·5 dm. long, up to 2·5 dm.; sheaths persisting during the flowering period, then falling, loosely convolute, lanceolate to linear-lanceolate, acute, mucronate, subcoriaceous, the lower striate, the upper almost smooth, at first grey-green, ultimately partly or wholly light brown, mostly 3–5 cm. long; male inflorescence oblong to linear-oblong, compact, 4–12 cm. long, rarely more; spathes persistent, erect-spreading, lanceolate to oblong-lanceolate, acute, mucronate, more or less expanded, chartaceous, smooth, light brown, 2–3·5 cm. long; spathellae rather conspicuous, lanceolate, acuminate, mucronate, chartaceous, about 1 cm. long; spikelets very numerous, in dense panicled cymes, ovate or rounded, 3–10-flowered, 2–5 mm. long; barren bracts absent; fertile bracts rounded, membranous, about half as long as the flowers; perianth oblong to ovate, 1·75 mm. long; segments oblong, obtuse, submembranous; the outer lateral somewhat carinate; the inner twice as long as the outer; female inflorescence spiciform, 4–8 cm. long; spathes imbricate, convolute at base, somewhat expanded above, otherwise as in the male; spathellae deltoid-lanceolate, acute, mucronate, chartaceous, rigidly carinate on the dorsal angle, about 3 mm. long; spikelets numerous, hidden by the spathes, in short panicled cymes, oblong, usually 5–8-flowered, 5–8 mm. long; bracts ovate, obtuse

to acute, obtusely keeled, coriaceous, membranous at the margins, 1·75 mm. long; perianth sessile, oblong-pyriform, triquetrous, 2·25–2·5 mm. long; segments linear-oblong, obtuse, cartilaginous; the outer obtusely keeled; the inner slightly exceeding or equalling the outer; ovary pyriform, triquetrous; styles 3, stout, abruptly recurved; fruit much exserted beyond the persistent perianth, deeply 3-lobed, scabrid, chestnut-brown.

South Africa : without precise locality, *Thom*, ♀.

Cape Province—Cape Div.: Doornhoogte, *Ecklon and Zeyher*, ♂ and ♀; Cape Flats, near Wynberg, *Bolus*, 3903, ♀; marshy ground at base of the Steenberg, *Pillans*, 3951, ♂ and ♀.—Paarl Div.: mountains at Paarl, *Drège*, 117, ♂ and ♀.—Mossel Bay Div.: Mossel Bay, *Rogers*, 4117*a*, ♀, 4224, ♂ and ♀, 4224*b*, ♂, 4228, ♂ and ♀.—Knysna Div.: Plettenberg's Bay, *Pappe in Herb. Mus. Austr.-Afr.*, 12838, ♂; seven miles east of Knysna, *Schönland*, 3615, ♀.—Humansdorp Div.: Witte Els Bosch, *Fourcade*, 1372, ♂ and ♀; near Clarkson, *Britten*, 1031, ♂.—Uitenhage Div.: Van Staden's, *Paterson*, 900, ♂.

Var. β, parviflora (*Pillans*); male flowers smaller than in the typical form; female inflorescence linear; spathes more closely imbricate and convolute, red-brown; perianth 1·5 mm. long; otherwise as in the typical form.

South Africa : Cape Province—Uitenhage Div.: Witteklip, near Van Staden's, *MacOwan*, 2153, ♂ and ♀.

19. E. juncea, *Linn., Mant.*, ii, 297 (1771)!; *Thunb., Prodr. Cap.*, 14 (1794); *Willd., Sp. Pl.*, iv, pars 2, p. 729 (1806); *Ait., Hort. Kew.*, v, 368 (1813), excl. syn. *Restio thyrsifer, Rottb.*; *Thunb., Fl. Cap.*, ed. 1, p. 311 (1811); ed. *Schultes*, 81 (1823), excl. syn. *R. thyrsifer*; *Kunth, Enum.*, iii, 464 (1841); *Steud., Synops.*, ii, 261 (1855); *Mast. in Journ. Linn. Soc.*, x, 241 (1868), excl. syn. *R. thyrsifer, R. membranaceus et R. intermedius*; *in DC. Monog. Phan.*, i, 357 (1878), excl. syn. *R. thyrsifer, R. membranaceus et R. intermedius*; *in Journ. Linn. Soc.*, xxi, 583, 591, No. 17 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 515 (1895), excl. syn. *R. thyrsfer et R. intermedius*; *Mast. in Fl. Cap.*, vii, 109 (1897); *Marloth, Flora S. Afr.*, iv, fig. 13, *a*, tab. 16, *a*, p. 64 (1915): **Restio Elegia,** *Linn., Syst. Veg.*, ed. 13, p. 738 (1774); ed. 14, p. 882 (1784); ed. 15, p. 924 (1797): **R. thyrsifer,** *Poir. in Lam., Encycl. Meth.*, vi, 177 (1804), non *Rottböll*; [*Lam., Illus.*, tab. 804, fig. 3, *a–e* (1798)]; *Poir. in Lam., Tableau*, iii, 399 (1823): **R. propinquus,** *Nees in Linnaea*, v, 653 (1830): **R. erectus,** *Nees, op. cit.*, 655!, non *Thunberg*, excl. syn. *R. thyrsifer, cit. Thunb. et Sprengel*: **R. junceus,** *Nees, op. cit.*, 658: **Elegia propinqua,** *Kunth, Enum.*, iii, 473 (1841)!; *Steud., Synops.*, ii, 261; *Mast. in Journ. Linn. Soc.*, x, 242, incl. var., excl. syn. *E. thyrsifera, Persoon*; *in DC. Monog. Phan.*, i, 356; *in Journ. Linn. Soc.*, xxi, 582; *Durand et Schinz, Consp. Fl. Afr.*, v, 516, excl. syn. *E. thyrsifer, Pers. et*

forma minor (*Mast.*); *Mast. in Fl. Cap.*, vii, 108: **E. Kraussii,** *Hochst. in Flora*, 1845, p. 340!: **E. erecta,** *Nees ex Drège in Linnaea*, xx, 243 (1847)!, absque descript., excl. syn. *E. fistulosa, Kunth.*

Stems caespitose or occasionally sporadic, erect, simple or rarely bearing slender barren branches, rigid or slender, solid, terete, wrinkled, 4–11 dm. high, 1·25–2·75 mm. in diameter at the middle; sheaths caducous or a few sometimes persisting during the flowering period, oblong-lanceolate, acute to obtuse, with a slender mucro, coriaceous to subchartaceous, chartaceous at the apex and margins, somewhat striate, finely scabrid on the dorsal surface, red-brown, speckled buff colour, paler at the margins, 2–4 cm. long; male inflorescence loosely paniculate-cymose, occasionally with distinct branches, oblong to linear-oblong, many-flowered, 3–20 cm. long; spathes persisting during the flowering period, more or less expanded, sheath-like but slightly smaller; spathellae usually conspicuous, lanceolate, acute, chartaceous, mostly 8–15 mm. long; spikelets ovate, 3–5-flowered, about 3 mm. long; bracts closely convolute, ovate to orbicular, membranous, half as long as the perianth; perianth sessile, oblong, slightly compressed, 1·75–2 mm. long; segments ovate-oblong, obtuse, cartilaginous, membranous at the margins; the outer lateral slightly keeled; inner segments twice as long as the outer; female inflorescence spicately cymose, compact, oblong or linear-oblong, 4–20 cm. long; spathes as in the male but usually loosely convolute, rarely somewhat expanded; spathellae convolute, lanceolate to ovate-lanceolate, acuminate, mucronulate, chartaceous, with a rigid midrib, two-thirds to twice as long as the spikelets; spikelets mostly hidden by the spathes, sessile or subsessile, somewhat compressed, ovate to orbicular, 2–8-flowered, 3–5 mm. long; bracts convolute, oblong, obtuse, submembranous, membranous at the margins, reddish brown, half as long as the flowers; perianth sessile, oblong, 2–2·5 mm. long; outer segments linear-oblong, obtuse, subcoriaceous, membranous at the margins; the lateral carinate; the anterior with a conspicuous midrib; inner segments oblong, obtuse, cartilaginous, slightly exceeding the outer; ovary oblong-ovate, scabrid with minute tubercles, dark chestnut-brown; styles 3.

South Africa: without precise locality, *Oldenburg*, 163, ♂, *Thunberg*, ♂, *Forbes in Hort. Soc.*, 90, ♂, *Masson*, ♂, *R. Brown*, ♂ and ♀, *Thom*, 892, ♂, 1023, ♀, *Drège*, 103, ♂, 9604, ♂, *Berg*, ♂, *Harvey*, 389, ♂ and ♀, *Alexander*, ♀, *Bowie*, ♂.

Cape Province—Cape Div.: Cape Town, *Rehmann*, 1455, ♂; Table Mt., *MacGillivray*, 432, ♀, 367, ♂, *Bolus*, 2884, ♂, *Marloth*, 3192, ♂, *R and T. Fries*, 3083, ♂; Camp's Bay, *Burchell*, 353, ♀; Lion's Head, *Ecklon*, ♂, *Pillans*, 4371, ♂ and ♀; Devil's Peak, *Bolus*, 4456, ♂, 4457, ♀, *Rehmann*, 924, ♀; between Kirstenbosch and Constantia Nek, *Kensit in Bolus Herb.*, 16957, ♂, *Page in Bolus Herb.*, 16958, ♂; Steenberg, *Wolley-Dod*, 1266, ♂;

Muizenberg, *Zeyher*, 4331; Fish Hoek Mts., *Wolley-Dod*, 2967, ♂, *Kensit in Bolus Herb.*, 16959, ♂; Red Hill, *Rogers*, 11213, ♂; hills west of Simon's Town, *Pillans*, 3396, ♂ and ♀; flats south of Red Hill, *Pillans*, 2823, ♂ and ♀. —CALEDON DIV.: Houwhoek, *Burchell*, 8132, ♀; Genadendal, *Drège*, 1644, ♂ and ♀; Hottentots Holland Mts., *Zeyher*, ♂; Steenbras, *Rogers*, 11036, ♂.—PAARL DIV.: French Hoek Mts., *Pickstone*, 19, ♂ and ♀, 26, ♂, 27, ♀; Drakenstein Mts., *Bolus*, 4087, ♀.—TULBAGH DIV.: Tulbagh Kloof, *MacOwan*, 1676, ♂ and ♀; Great Winterhoek, *Phillips*, 1650, ♂.—CERES DIV.: Mitchell's Pass, *Bolus*, 9658, ♀.—WORCESTER DIV.: Du Toit's Kloof, *Bolus*, 7497, ♀; Onklaarberg, *Stokoe*, 1211, ♂, 1212, ♀.—LITTLE NAMAQUALAND: Kamiesberg, *Drège*, 89 partly, ♂.—RIVERSDALE DIV.: Garcia's Pass, *Bolus*, 11404, ♂, 11405, ♀; Glen Leith, *Muir*, 3304, ♂ and ♀.—LADISMITH DIV.: Klein Zwartberg, *Marloth*, 3653, ♂.—OUDTSHOORN DIV.: Zwartberg Pass, *Tugwell in Bolus Herb.*, 14290, ♂.—UNIONDALE DIV.: Prince Alfred's Pass, *Fourcade*, 2064*b*, ♀.—HUMANSDORP DIV.: Witte Els Bosch, *Fourcade*, 835, ♂ and ♀.—UITENHAGE DIV.: Winterhoek, *Krauss*, ♂; Witte Klip, *MacOwan*, 2152, ♀; Van Staden's, *Paterson*, 2426, ♂.

Var. *β*, **geniculata** (*Pillans*); stems frequently bent, often producing barren branchlets at the bends; flowers 1·75 mm. long; outer perianth-segments deeply keeled, mostly with recurved teeth on the keels.

South Africa: Cape Province—CAPE DIV.: summit of Koeberg, *Pappe*, ♂ and ♀.

E. Meyer applied his manuscript name *Chondropetalum strobiliferum* to plants of *Elegia juncea*, L. in various herbaria.

20. E. thyrsifera, *Pers., Syn. Pl.*, ii, 607 (1807), excl. syn. *E. juncea, Thunb. et cit. Lamarck*; *Kunth, Enum.*, iii, 465 (1841), excl. syn. *R. erectus, Thunb., E. juncea herb. Sieber et cit. mult.*; *Mast. in Journ. Linn. Soc.*, xxi, 585 (1885), quoad pl. fem.; *Durand et Schinz, Consp. Fl. Afr.*, v, 516 (1895); *Mast. in Fl. Cap.*, vii, 107 (1897), quoad pl. fem.: **Restio thyrsifer,** *Rottb., Program.*, p. 11 (1772), *ejusd. Descr. et Icon. Rar.*, p. 8, tab. 3, fig. 4 (1773): **Elegia juncea,** *Spreng., Syst. Veg.*, i, 362 (1825), non *Linn.*: **E. acuminata,** *Mast. in Journ. Linn. Soc.*, xxi, 580 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 108 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900).

Stems caespitose, erect, simple or with a few fascicled barren branchlets arising at the upper nodes, terete, solid, finely wrinkled or smooth, with a silvery iridescence, 0·9–2·1 m. high, 2·5–5 mm. in diameter at the middle; sheaths mostly persisting during the flowering period, loosely convolute, linear-oblong, acute, mucronate, coriaceous, thinner at the margins and caducous apex, brown, 5–8 cm. long; male inflorescence paniculate-cymose, dense, oblong to linear-oblong, 5–15 cm. long; spathes persisting during the flowering period, sheath-like but smaller; spathellae often conspicuous,

ovate to lanceolate, acuminate, aristate, subcoriaceous to chartaceous, light brown, 4–18 mm. long; spikelets compressed, conical, densely 3–6-flowered, 3–4 mm. long; bracts ovate, acute, mucronate, cartilaginous, with a prominent midrib, 1·75–2·75 mm. long; perianth straight or slightly curved in the upper part, 2–2·5 mm. long; outer segments oblong-ovate, acute, mucronate, cartilaginous; the lateral carinate; inner segments linear-oblong, acute, mucronate, cartilaginous, twice as long as the outer; female inflorescence resembling the male but more compact, mostly 4–6 cm. long; spathes and spathellae as in the male; spikelets not or only partly hidden by the spathes, 3–4-flowered; bracts broadly ovate, rounded, obtuse or acute at apex, mucronate, cartilaginous, 1·5–2·5 mm. long; perianth oblong, 2·5–3 mm. long; segments linear-oblong, acute, mucronulate, cartilaginous, thinner at the margins, equal or subequal; outer segments carinate, scabrid on the keel; ovary obovoid or pyriform, tapered towards the base, obliquely trigonous, winged at the angles, red; styles 3, distinct at their bases, stout, reflexed in their upper parts.

South Africa : without precise locality, *Oldenburg*, 1038, ♀; *Forbes in Hort. Soc.*, 91, ♂, *Thom*, ♀, *Drège*, 104, ♂, *Verreaux*, ♂ and ♀.

Cape Province—Cape Div.: Table Mt., above Kirstenbosch, *Bolus*, 4640, ♂ and ♀; slopes towards Kirstenbosch, *Wolley-Dod*, 2389, ♂; Cecilia, *Page in Bolus Herb.*, 17658, ♂; plateau on Table Mt., *Marloth*, 3130, ♀, 3139, ♂, *Wolley-Dod*, 2149, ♀; on the Muizenberg, *Moss*, 7884, ♂; Red Hill, *Bolus*, 15679, ♀; Silver Mine Valley, *Pillans*, 3393, ♂, 3394, ♀; plateau on Karbonkel Berg, *Pillans*, 4134, ♀.—Swellendam Div.: at the base of the Lange Bergen, near Swellendam, *Burchell*, 7435, ♂.—Riversdale Div.: Garcia's Pass, *Burchell*, 6993, ♂ and ♀.—Humansdorp Div.: Hofmansbosch, *Britten*, 1141, ♂, 1380, ♂; Rooipunt River, *Fourcade*, 2184, ♂ and ♀.

21. E. racemosa, *Pers., Synops. Pl.*, ii, 607 (1807) !, quoad plant. masc.; *Drège, Zwei Pfl. Documente*, 82 (1844); *Steud., Synops.*, ii, 261 (1855), quoad plant. masc.: **Restio racemosus,** *Poir. in Lam., Encycl. Meth.*, vi, 177 (1804), quoad plant. masc.; [*Lam., Ill.*, tab. 804, fig. 4*f* (1798), absque nomine]; *Poir. in Lam., Tab. Encycl. Meth.*, iii, 400 (1823), quoad plant. masc.: **Dovea racemosa,** *Mast. in Journ. Linn. Soc.*, xxi, 578 (1885), quoad plant. masc.; *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 103 (1897), quoad plant. masc.: **Elegia fusca,** *N. E. Br. in Fl. Cap.*, vii, 754 (1900) !: **E. persistens,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 8 (1900) !.

Stems sporadic on creeping rhizomes, erect, simple, terete, solid, rigid, wrinkled, 5–10 dm. high, 2–3 mm. in diameter at the middle; sheaths deciduous, or occasionally a few persisting during the flowering period, oblong to lanceolate-oblong, acute, mucronulate, coriaceous, more or less striate, finely scabrid with raised cells, red-brown, speckled buff colour,

membranous and pale at the margins, 2·5–4 cm. long; male inflorescence paniculate-cymose, narrow, straight or slightly flexuose, many-flowered, 1·2–1·6 dm. long; spathes persistent or subpersistent, expanded, recurved at the margins, otherwise sheath-like, 3·5–5·5 cm. long, up to 2 cm. broad; branches of the inflorescence mostly 2·5–3·5 cm. long; spathellae inconspicuous, linear-oblong, acute, membranous; spikelets broadly oblong, laxly 2–4-flowered, 2·5–4 mm. long; bracts broadly ovate, obtuse, membranous, 0·75–1 mm. long; perianth distinctly stipitate, oblong, 1·75–3 mm. long; segments oblong, obtuse, cartilaginous; the outer lateral with a prominent midrib; inner segments somewhat galeate at the apex, twice to nearly three times as long as the outer; female inflorescence spicate-cymose, compact, narrow, 6–18 cm. long; branches of the inflorescence hidden by the spathes, mostly under 1 cm. long; spathes imbricate from a third to half their length, loosely convolute, otherwise as in the male; spathellae minute, ovate to rotund, or oblong to deltoid, or appearing as a narrow frill, hyaline-membranous to cartilaginous, rarely up to 3·5 mm. long; spikelets 1–3-flowered; bracts orbicular to transversely oblong, acute or rounded, or vestigial, hyaline-membranous, 0·25–1·5 mm. long; perianth sessile, subtriquetrous, oblong to oblong-ovate, 2–3·5 mm. long; segments linear-oblong to ovate-oblong, obtuse to acute, cartilaginous, membranous at the margins; the outer subcarinate; inner segments equalling or exceeding the outer by a third of the length of the former; ovary obovate, compressed, with a keel down each of the angles, finely scabrid; styles 2 or 3.

South Africa: without precise locality, *Thunberg*, ♂, *Thom*, 904, ♂, *Buchanan in Natal Govt. Herb.*, 3623, ♂.

Cape Province—Cape Div.: Table Mt., *Burchell*, 574, ♂, *R. Fries*, ♀, *Pillans*, 3395, ♂ and ♀, *Mogg in S.A. Nat. Herb.*, 1037, ♂, *Moss*, 7836, ♂; head of Farmer Peck's Valley, on the Muizenberg, *Pillans*, 4370, ♀; south slopes of the Simon's Berg, *Pillans*, 4373, ♂.—Caledon Div.: Houwhoek, *Burchell*, 8067, ♂ and ♀, *Schlechter*, 7771, ♂, 7772, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 1647, ♂.—Riversdale Div.: Garcia's Pass, *Burchell*, 6999, ♂ and ♀; Lange Bergen, *Schlechter*, 1923, ♂ and ♀.—George Div.: Cradock Berg, *Galpin*, 4802, ♀.—Uitenhage Div.: Witte Klip, *MacOwan*, 2150, ♂.

22. E. fenestrata, *Pillans*, sp. nov.; culmis erectis simplicibus robustis teretibus solidis; vaginis subpersistentibus lineari-oblongis mucronatis coriaceis partibus superioribus fenestratis; inflorescentia mascula dense paniculato-cymosa; spathis caducis vaginiformibus, expansis; spiculis 5–8-floris; bracteis arcte convolutis subrotundis cartilagineis; perianthio breviter stipitato ovato-oblongo; segmentis exterioribus ovatis obtusis cartilagineis; segmentis interioribus oblongis obtusis quam exteriora fere

duplo longiora ; inflorescentia feminea dense paniculato-cymosa ; spathis ut in mare ; spiculis rotundis 5–8-floris ; bracteis ut in mare ; perianthio sessili trigono oblongo ; segmentis oblongis obtusis vel subacutis cartilagineis ; ovario ovato trigono stylopodio corneo superato ; stylis 3 brevibus.

Stems arising sporadically from creeping rhizomes, simple, stout, terete, solid, 1·5–2·1 m. high, about 5 mm. in diameter at the middle ; sheaths usually persisting up to or during the flowering period, linear-oblong, subacute, mucronate, coriaceous, chestnut-brown, 5–8 cm. long, the upper part soon loosing its apex and inner lining, becoming cell-pitted and perforated by the disintegration of cells ; male inflorescence paniculate-cymose, dense, oblong to linear-oblong, 1–1·5 dm. long ; spathes mostly falling before the flowers mature, sheath-like, expanded, chestnut-brown ; spathellae numerous and conspicuous, oblong-lanceolate, acute, mucronulate, expanded, with a prominent median nerve, cartilaginous, ferruginous, 1·5–2 cm. long ; spikelets densely clustered, ovate or subrotund, 5–8-flowered, 4–5 mm. long ; bracts closely embracing the flowers, subrotund, cordate at base, rounded and muticous at apex, cartilaginous, membranous at the margins, 0·75–2 mm. long ; perianth shortly stipitate, ovate-oblong, 2·5–3 mm. long ; outer segments ovate, obtuse, muticous, cartilaginous, membranous at the margins, dorsally rugulose and cell-pitted ; the lateral navicular, carinate on the upper half ; inner segments oblong, obtuse, cartilaginous, rugulose and cell-pitted on the upper half, scarcely twice as long as the outer ; female inflorescence paniculate-cymose, oblong, compact, about 7 cm. long ; spathes and spathellae as in the male but slightly smaller ; spikelets numerous, mostly exposed, crowded on branchlets, ovate or rotund, brown, 5–8-flowered, 4–5 mm. long ; bracts as in the male ; perianth sessile, trigonous, oblong, 2·25–2·75 mm. long ; segments oblong, obtuse or subacute, muticous, cartilaginous, rugulose on exposed parts ; the outer lateral navicular, with a median keel ; ovary ovate or oblong-ovate, trigonous, with a hard keel on each of its lateral angles, surmounted by a horny stylopodium, ferruginous ; styles 3, short, recurved in their upper parts.

South Africa: Cape Province—Cape Div. : marshy places between hills west of Buffels Bay, Cape Peninsula, *Pillans*, 4144, ♂ and ♀ (type).

23. E. thyrsoidea, *Pillans in Ann. Bolus Herb.*, iii, 146 (1922) : **Dovea thyrsoidea,** *Mast. in Journ. Linn. Soc.*, x, 251 (1868) ! ; *in DC. Monog. Phan.*, i, 309 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895) ; *Mast. in Fl. Cap.*, vii, 104 (1897) ; *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900).

Stems erect, simple, stout, terete, solid, finely wrinkled and impresso-punctate, grey-green, 1–1·5 m. high, 4–5 mm. in diameter at the middle ; sheaths mostly persistent during the flowering period, subsequently falling,

loosely convolute, linear-oblong, shortly acute, coriaceous, striate, puncticulate, light brown, mostly 6–8 cm. long; male inflorescence paniculate-cymose, linear-oblong, densely many-flowered, often interrupted in the lower parts, 1–2 dm. long; spathes deciduous during the flowering period, sheath-like, oblong or elliptic, the lower 5–6 cm. long; spathellae inconspicuous, membranous; spikelets in dense clusters, 2–4-flowered, 2·5–3·5 mm. long; bracts closely convolute, oblong-ovate, obtuse, membranous, 0·75–1·5 mm. long; flowers secund, oblong, 1·75–2·5 mm. long; outer perianth-segments ovate, subacute, cartilaginous; inner segments oblong, obtuse, and somewhat galeate at the apex, cartilaginous, twice as long as the outer; female inflorescence narrow, spicate-cymose, compact, 1–3 dm. long; spathes persistent, sheath-like, imbricate, loosely convolute, the lower 4–5 cm. long; branches of the cymes hidden by the spathes, laxly many-flowered; spathellae navicular, oblong-lanceolate, acute, cartilaginous, scabrid with raised cells, 6–8 mm. long; spikelets 2–3-flowered, about 3 mm. long; bracts convolute, ovate, obtuse, cartilaginous, narrowly membranous at the margins, about 1·5 mm. long; perianth oblong, somewhat compressed, 2·75–3·25 mm. long; outer segments ovate-oblong, subacute, more or less carinate, cartilaginous, inner segments oblong subacute, cartilaginous, slightly exceeding the outer; ovary oblong, slightly tapered downwards at the base, obtuse at the apex, finely scabrid, red; styles 3, two being adjacent, one isolated.

South Africa: Cape Province—George Div.; summit of Post Berg, near George, *Burchell*, 5895, ♂ and ♀; Cradock Berg, *Galpin*, 4799, ♂ and ♀; George, *Rogers*, 4368, ♂ and ♀.—Uniondale Div.: headwaters of Wagenbooms River, *Fourcade*, 2345, ♂ and ♀.

24. E. Galpinii, *N. E. Br. in Fl. Cap.*, vii, 754 (1900) !.

Stems erect, simple, stout in their lower parts, slender but rigid in their upper parts, terete, minutely punctate and scabrid, about 1·2 m. high, about 3 mm. in diameter at the middle; sheaths not seen; male inflorescence paniculate-cymose, narrow, attenuate, interrupted, 1–3 dm. long; branches of the inflorescence densely many-flowered, up to 4 cm. long; spathes not seen; spathellae inconspicuous: spikelets oblong, mostly 8–10-flowered, dark chestnut-brown, 3·5–5 mm. long; bracts closely convolute, roundish, cartilaginous, punctate, 1·25 mm. long; perianth oblong, 2 mm. long; outer segments ovate, obtuse, cartilaginous, punctate; the lateral slightly carinate; inner segments oblong, obtuse, cartilaginous, punctate, twice as long as the outer; female inflorescence like the male but up to 5 dm. in length; spathes falling during the opening of the flowers, oblong-lanceolate, acute, expanded, coriaceous, thinner at the margins, obscurely striate, brown, the lower about 5 cm. long; branches of the inflorescence densely many-flowered, up to 5 cm. in length; spathellae broadly lanceolate,

acute, with a prominent midrib, coriaceous, up to 1·2 cm. long; spikelets irregular in shape, more or less 2-sided, mostly 4- or 5-flowered, 3–4 mm. long; bracts deltoid, acute to ovate, obtuse, cartilaginous, dorsally scabrid, 2 mm. long; perianth roundish, 2 mm. long; outer lateral segments ovate, subacute or obtuse, carinate, cartilaginous, dorsally scabrid; the anterior ovate-oblong, obtuse; inner segments broadly ovate, obtuse, slightly exceeding the outer in length; ovary subglobose, obtusely 3-angled, rugose; styles 3, separated at base, short; nut subglobose, rugose, blackish.

South Africa: Cape Province — RIVERSDALE DIV.: Garcia's Pass, *Galpin*, 4803, ♂ and ♀, *Bolus*, 11402, ♂, 11403, ♀, *Marloth*, 3641, ♀, *Muir*, 3182, ♂, 3183, ♀; Phisantefontein, north slopes of Lange Bergen, *Muir*, 3199, ♂, 3200, ♀.

25. E. cuspidata, *Mast. in Journ. Linn. Soc.*, x, 240 (1868)!; *in DC. Monog. Phan.*, i, 354 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 514 (1895); *Mast. in Fl. Cap.*, vii, 109 (1897).

Stems caespitose, erect, simple, stout, terete in their lower parts, somewhat compressed upwards, smooth, 9–11 dm. high, 4–5 mm. in diameter at the middle; sheaths persisting during the flowering period, loosely convolute, lanceolate-oblong, acute, subulate-mucronate, smooth, minutely pitted, coriaceous, shiny, chestnut-brown, 5·5–7·5 cm. long; male inflorescence narrow, somewhat interrupted, composed of compact panicled cymes which are arranged in fascicles of 2–3 at the nodes, mostly 1·5–2·5 dm. long; spathes deciduous, sheath-like but expanded and smaller; spathellae inconspicuous, oblong, acuminate, aristate, cartilaginous, 4–5 mm. long; spikelets closely arranged, 5–6-flowered; bracts closely convolute, ovate, obtuse, submembranous, with a rigid midrib and long filiform, slightly scabrid awn, 1·75–2 mm. long; perianth arcuate, lanceolate, 3 mm. long; segments cartilaginous, finely scabrid; the outer oblong, acute, mucronulate, reaching to the middle of the inner; inner segments linear-oblong, acute, mucronulate; the posterior distinctly the shortest; female inflorescence resembling the male, but usually shorter and with the spikelets more closely packed; spathes and spathellae as in the male but smaller; spikelets as in the male but denser; bracts oblong-ovate, 2·75–3 mm. long, otherwise as in the male; awns about 5 mm. long; perianth slightly arcuate, not distinctly triquetrous, oblong, 3 mm. long; segments oblong, acute, mucronulate, with a prominent midrib, cartilaginous, rugulose, equal or subequal; ovary pyriform, conical at the apex; styles 3; fruit smooth, shiny, black.

South Africa—CAPE DIV.: "Simon's Bay," *MacGillivray*, 437, ♀, *Milne*, 233, ♂; on mountains near Simon's Town, *Guthrie*, 1318, ♀, *Wolley-Dod*, 1813, ♂, *Pillans*, 3966, ♂ and ♀; Klaver Vley, *Moss*, 7864, ♂ and ♀; Buffelsfontein, *L. Bolus in Bolus Herb.*, 16943, ♂, *Wolley-Dod*, 2875, ♂,

Pillans, 4365, ♂.—CALEDON DIV.: Hottentots Holland Mts., *Stokoe in Bolus Herb.*, 17660, ♂.

IV, LEPTOCARPUS, *R. Br., Prodr. Fl. Nov. Holl.*, p. 250 (1810); *Linn., Syst. Veg.*, ed. 16, i, p. 129 (1825); *Endl., Gen. Pl.*, 121 (1836); *Kunth, Enum.*, iii, 480 (1841); *Meisner, Gen. Pl.*, 408 (1842); *Steud., Synops. Pl.*, ii, 260 (1855); *Hook. f., Fl. New Zeal.*, i, 265 (1855); *ej. Fl. Tasman.*, ii, 72 (1860); *ej. Handbook N. Zeal. Fl.*, 294 (1864); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 413 (1868); *Mast. in DC. Monog. Phan.*, i, 329, tab. ii, figs. 38–45, tab. v, fig. 9 (1878); *Benth., Fl. Austral.*, vii, 230 (1878); *Benth. et Hook., Gen. Pl.*, iii, 1032 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 8 (1888); *Mast. in Fl. Cap.*, vii, 116 (1897): **Calopsis,** *Beauv. ex Desv. in Ann. Sc. Nat.*, xiii, 44, tab. iii, fig. 2 (1828); *Meisner, Gen. Pl.*, 408; *Kunth, Enum.*, iii, 421; *Endl., Gen. Pl.*, Suppl. 2, p. 11 (1842); *Steud., Synops. Pl.*, ii, 257.

Flowers dioecious. Male spikelets many in panicled cymes, few in spicate cymes or solitary and terminal, ovate, obovate, oblong, lanceolate or cuneate, many-flowered. Perianth compressed; segments 6, the outer lateral usually navicular, more or less villous on the median nerve or glabrous. Rudimentary ovary with 3 minute styles or absent. Female spikelets resembling the male, many-, few-, or, by abortion, 1-flowered. Perianth as in the male or subtrigonous. Staminodes minute or absent. Ovary usually trigonous, rarely compressed, 1-celled; styles 3, free or connate in the lower half, rarely connate above the middle. Fruit trigonous, elliptic or ovoid, indehiscent.

Flowering stems tufted or arising from creeping rhizomes, erect, branched from below the middle upwards, rarely simple, terete. Leaf-sheaths closely convolute or occasionally loose in their upper parts, persistent. Barren stems often present, shorter, much branched.

The genus occurs also in tropical and south-west Australia; single species are recorded from Tasmania, New Zealand, Chili, and Cochin China.

Key based on Characters in the Female Plants.

Outer lateral perianth-segments winged:
- Spikelets 2- or 3-flowered, at first cuneate, becoming ovate or ovate-oblong, always distinctly cuneate at base:
  - Spikelets 1–1·5 cm. long; perianth 5–6 mm. long . . . . (1) *impolitus.*
  - Spikelets 0·6–0·8 cm. long; perianth 3–3·5 mm. long . . . (2) *hyalinus.*
- Spikelets many-flowered, linear-lanceolate or oblong. . . . . (7) *distichus.*

Outer lateral perianth-segments not winged:
- Inflorescence a much-branched panicle, 1·5–2 dm. long . . . (16) *paniculatus.*
- Inflorescence spicate, racemose or paniculate, much smaller:
  - Spikelets solitary and terminal on the branches . . . . (5) *gracilis.*

Spikelets not solitary and terminal :
Leaf-sheaths with their upper parts white-membranous and deciduous :
Spikelets 1-flowered, sometimes also with 1 rudimentary flower, 6–8 mm. long ; outer perianth-segments densely clothed with white, woolly hairs on the midrib . . . . . (3) *asper.*
Spikelets 1- or 2-flowered, 4–5 mm. long ; outer lateral perianth-segments glabrous . . . . . (4) *membranaceus.*
Spikelets 1–3-flowered, 5–10 mm. long ; outer lateral perianth-segments glabrous or minutely puberulous on the carina . . . . . (9) *rigidus.*
Leaf-sheaths not as above :
Stems studded with whitish tubercles :
Bracts linear-lanceolate, acuminate, 10–12 mm. long . . (6) *ejuncidus.*
Bracts oblong, acute, about 6 mm. long . . . . (10) *Burchellii.*
Stems obscurely tubercled, wrinkled, velvety pubescent or nearly smooth :
Leaf-sheaths tightly embracing the stem . . . (8) *Andreaeanus.*
Leaf-sheaths loosely embracing the stem :
Outer lateral perianth-segments linear or linear-oblong, acute or acuminate :
Outer lateral perianth-segments linear, glabrous ; inflorescence spicate, (12) *fruticosus.*
Outer lateral perianth-segments linear-oblong, obscurely villous on the midrib or glabrous ; inflorescence paniculate . . (14) *Muirii.*
Outer lateral perianth-segments oblanceolate or oblong :
Outer lateral perianth-segments with a few papilliform hairs on the midrib or glabrous . . . . . (13) *Marlothii.*
Outer lateral perianth-segments densely villous on the midrib :
Mature leaf-sheaths erect . . . . . (11) *rigoratus.*
Mature leaf-sheaths with their upper parts erect-spreading, (15) *viminous.*

1. L. impolitus, *Pillans*, comb. nov. : **Restio impolitus,** *Kunth, Enum.*, iii, 404 (1841) ! ; *Drège, Zwei Pfl. Documente*, 109, 110 (1844) ; *Steud., Synops. Pl.*, ii, 253 (1855) ; *Mast. in Journ. Linn. Soc.*, viii, 249 (1865) ; *Mast., op. cit.*, x, 279 (1868) : **Hypolaena impolita,** *Mast. in Journ. Linn. Soc.*, x, 264 ; *op. cit.*, xiv, 418, sub No. 22 (1875) ; *Mast. in DC. Monog. Phan.*, i, 370 (1878) ; *Mast. in Journ. Linn. Soc.*, xxi, 591, No. 19 (1885) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895) ; *Mast. in Fl. Cap.*, vii, 131 (1897) : **Restio triticeus,** *Thunb. Herb. pl. masc. Mast. in Journ. Linn. Soc.*, xiv, 418 (1875) : **Calorophus impolitus,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891).

Stems erect, moderately branched in their upper parts, slender, terete, coarsely tubercled, about 6 dm. high, 1 mm. in diameter at the middle ; sheaths closely convolute except at the ramifications, oblong, broadly rounded to acute at the apex, subulate-mucronate, coriaceous, externally tubercled, 1–1·8 cm. long, with deciduous, hyaline-membranous lateral margins and with two hyaline lobes at the apex ; spathes sheath-like, 8–10 mm. long ; male spikelets numerous in panicled distichous cymes, sessile, many-flowered, ovate or ovate-oblong, cuneate in their lower parts,

much compressed, with one edge towards the rhachis, 1–1·5 cm. long; bracts distinctly spaced, leaving sections of the rhachilla exposed, distichous, erect-spreading, clasping the flowers, oblong-lanceolate, subacute to obtuse, muticous, decurrent at base, cartilaginous and light brown in the lower half, membranous and reddish in the upper, 5–7 mm. long; perianth subsessile, oblong, laterally compressed, 4–5 mm. long; the outer lateral segments with their upper parts curved towards the rhachilla and usually free from the others, with their sides complicate, linear-oblong, obtuse to acute, membranous, minutely villous on the cartilaginous carina, longer than the other segments; anterior segment expanded, linear-oblong, acute, hyaline-membranous; inner segments oblong or oblong-lanceolate, obtuse, hyaline-membranous, equalling the anterior; female inflorescence resembling the male but with the spikelets more widely spaced; spathes sheath-like, embracing the bases of the spikelets, 8–10 mm. long; spikelets sessile, as in the male but less compressed, mostly 3-flowered, 1–1·5 cm. long; bracts erect-spreading, loosely convolute, oblong-lanceolate, subacute, cartilaginous, reddish, with pale membranous margins, 8–9 mm. long; perianth much exposed beyond the sides of the bract, sessile, broadly ovate to suborbicular, with its upper part curved towards the rhachilla, dorsally compressed, 5–6 mm. long; outer lateral segments navicular, linear-oblong, acute, cartilaginous, winged; wings clasping the base of the bract next above, falcate in outline, narrowest at the apex, coriaceous, retrorsely striate and lacerate, red-brown, 1·5–2 mm. in diameter; anterior segment linear, acute, cartilaginous, reddish, shorter than the lateral; inner segments oblong-lanceolate, acute to obtuse, hyaline-membranous, white, equalling or exceeding the outer; ovary linear-oblong, narrowed and hardened at its apex, trigonous, with prominent angles, longitudinally nerved; styles 3, free or variously united throughout a half or more of their length, erect, straight and rigid in their lower parts, twisted and slender in their upper.

South Africa: without precise locality, *Thunberg*, ♂, *Bachmann*, 1767, ♀.

Cape Province—Cape Div.: at the base of Table Mt. towards Camp's Bay, *Ecklon*, 36 partly, ♂.—Stellenbosch Div.: Kuils River, *Kayser in Bolus Herb.*, 17134, ♂.—Malmesbury Div.: Hopefield, *Bolus*, 12895, ♀.—Piquetberg Div.: between Krom River and Pietersfontein, *Drège*, 66, ♂.—Clanwilliam Div.: between Lange Vley and Heeren Logement, *Drège*, 67, ♂.

2. L. hyalinus, *Pillans*, comb. nov.: **Hypolaena hyalina,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 13 (1900) !.

Stems caespitose, erect, moderately branched from below the middle upwards, slender, terete, tubercled, 3–5 dm. high, 0·75–1 mm. in diameter at

the middle; sheaths closely convolute, oblong, obtuse to acute, mucronate to aristate, coriaceous, dorsally smooth or obsoletely tubercled on the lower half, with the upper margins produced into two deciduous hyaline-membranous lobes, ferruginous, 8–15 mm. long; male spikelets numerous, in spicate or distichous cymes, erect, compressed, with one edge facing the rhachis, oblong, cuneate in their lower parts, several-flowered, 8–10 mm. long; spathes clasping the bases of the spikelets, sheath-like, 6–8 mm. long; bracts distinctly spaced so as to leave sections of the rhachilla exposed, loosely convolute, linear-oblong, acute, muticous, cartilaginous, membranous in their upper parts, 6–9 mm. long; perianth subsessile, oblong, laterally compressed, 3·5–4 mm. long; outer lateral segments navicular, linear-oblong, acute, slightly twisted and curved in their upper parts towards the rhachilla, membranous, glabrous; anterior segment linear, acute, membranous; inner segments oblong-lanceolate, obtuse or subacute, distinctly shorter than the outer; female inflorescence resembling the male; spikelets numerous, distichous, cuneate, 2–3-flowered, 6–8 mm. long; spathes and bracts as in the male; perianth subsessile, much exposed beyond the sides of the bract, ovate to suborbicular, dorsally compressed, 3–3·5 mm. long; outer lateral segments linear, acute, navicular, cartilaginous, winged on the carina; wings embracing the base of the bract next above, falcate in outline, narrowed at both ends, cartilaginous, retrorsely striate and lacerate, red-brown, 0·75–1 mm. in diameter; the anterior segment linear, acute to obtuse, membranous; inner segments linear-lanceolate, acute to obtuse, hyaline-membranous, shorter than the outer; ovary linear-oblong, trigonous, longitudinally nervose, hardened at the angles and apex, reddish; styles 3, erect, free or variously united from their bases to about half their length.

South Africa: Cape Province—Caledon Div.: Houwhoek, *Zeyher*, 4349 partly, ♂ and ♀; near Mossel River, Hermanus, *Guthrie in Bolus Herb.*, 17627, ♂, 17661, ♂; Zwartberg, *Pillans in Bolus Herb.*, 17699, ♂.—Bredasdorp Div.: Koude River, *Schlechter*, 10463, ♂, 10464, ♀.—Paarl Div.: French Hoek Mts., *Pickstone*, 1, ♂.—Tulbagh Div.: Tulbagh Kloof, *MacOwan in Herb. Austr.-Afr.*, 1677, ♀.

3. L. asper, *Pillans*, comb. nov.: **Hypolaena aspera,** *Mast. in Journ. Linn. Soc.*, x, 264 (1868)!, partim; *in DC. Monog. Phan.*, i, 371 (1878), partim; *Durand et Schinz, Consp. Fl. Afr.*, v, 521 (1895), partim; *Mast. in Fl. Cap.*, vii, 133 (1897): **Calorophus asper,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891).

Stems caespitose, erect, moderately branched in their upper parts, slender, terete, coarsely tubercled, 3–5 dm. high, about 0·75 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acuminate, slender-mucronate, coriaceous, deeply hyaline-membranous at the apex,

1–1·5 cm. long; male spikelets numerous, in laxly panicled cymes, linear-oblong, 1-3-flowered, 6–10 mm. long; spathes clasping the spikelets, sheath-like, slightly shorter than the accompanying spikelet; bracts separated at their bases by about half their length and distinctly decurrent on the rhachilla, closely clasping and equalling the flowers in number, linear-lanceolate, acute, cartilaginous, deeply pale-membranous at the apex, 4–6 mm. long; perianth subsessile, oblong, 2·75–3·25 mm. long; outer segments linear, acute, submembranous; the inner linear-lanceolate, acute, hyaline-membranous, shorter than the outer; female spikelets numerous, in laxly panicled cymes, linear-oblong, by abortion 1-flowered, with an occasional rudimentary flower within the bract next above, 6–8 mm. long; spathes as in the male; bracts about 4, closely imbricate, oblong-lanceolate, acute, with a soft mucro, cartilaginous, pale-membranous in the upper half, 4–8 mm. long; perianth sessile, oblong, terete, 2·5–2·75 mm. long; segments oblong-lanceolate, obtuse, somewhat bifid at the apex, dorsally rounded, hyaline-membranous, subequal; the outer densely pubescent with white, woolly hairs on the midrib; ovary sessile, ovate, narrowed at the apex into a horny cap, unequally triquetrous, soft in texture, with 3 horny perpendicular ridges, rugulose, purple; styles 3, free.

South Africa: without precise locality, *Thom*, 632*a*, ♂.

Cape Province—Caledon Div.: Hottentots Holland Mts., *Ecklon and Zeyher*, ♂ and ♀; Grietje's Gat, *Ecklon and Zeyher*, ♂ and ♀; Houwhoek Mts., *Burchell*, 8069, ♂.

4. L. membranaceus, *Pillans*, comb. nov.: **Hypolaena Burchellii,** *Mast. in Journ. Linn. Soc.*, x, 268 (1868)!; *in DC. Monog. Phan.*, i, 374 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 521 (1895); *Mast. in Fl. Cap.*, vii, 134 (1897): **Calorophus Burchellii,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891).

Stems sporadic on creeping rhizomes, rarely subcaespitose, erect, moderately branched from below the middle upwards, wiry, rugulose, yellow-spotted, 3–5 dm. high, 1–2 mm. in diameter in the lower parts; sheaths closely convolute and coriaceous in their lower parts, loose and membranous in their upper, oblong-lanceolate, acute, slender-aristate, with the membranous portion deciduous, those on the main stems 1·2–1·5 cm. long; male inflorescence paniculate-cymose, mostly 3–5 cm. long; spathes like the upper sheaths; spikelets numerous, oblong, cuneate at base, many-flowered, mostly 5–7 mm. long; bracts loosely imbricate, oblong-lanceolate, mucronate, cartilaginous in the lower half, membranous in the upper, 4–5 mm. long; perianth on a stipe of about 0·5 mm. in length, oblong, compressed, oblique at the apex, 2 mm. long; outer segments linear-oblong, coriaceous; the lateral navicular, acute, minutely pubescent on the upper half of the midrib; the left segment exceeding the others in length; the anterior

dorsally rounded, obtuse; inner segments oblong, obtuse to subacute, membranous, slightly shorter than the outer; female inflorescence spicate or linear paniculate-cymose; spathes as in the male; spikelets few to many, 1–3-flowered, 4–5 mm. long; bracts as in the male; perianth on a short, stout, minutely puberulous stipe, for the most part nude, slightly compressed, oblong, obtuse at the apex, 2·75–3 mm. long; segments linear-oblong, cartilaginous; the outer lateral somewhat navicular, slightly keeled below the apex, acute, glabrous; the anterior dorsally rounded, obtuse; inner segments subacute, equalling the outer; ovary ovate, smooth; styles 3, free.

South Africa: Cape Province—Cape Div.: hills north of reservoirs on Table Mt., *Pillans*, 4175, ♂; hills at the source of the Silver Mine River, Steenberg, *Pillans*, 4141, ♂; mountains west of Simon's Town, *Pillans*, 2963, ♂.—Caledon Div.: Houwhoek Mts., *Burchell*, 8116, ♂, *Schlechter*, 7765, ♂; Baviaans Kloof, near Genadendal, *Burchell*, 7632 partly, ♂, 7894 partly, ♂; Zwartberg, *L. Guthrie in Bolus Herb.*, 14136, ♂ and ♀, 16013, ♂.

5. L. gracilis, *Pillans in Ann. Bolus Herb.*, iii, 146 (1922): **Hypolaena gracilis** [*Nees ex Drège in Linnaea*, xx, 240 (1847)!, nomen]; *Mast. in Journ. Linn. Soc.*, x, 266 (1868)!; *in DC. Monog. Phan.*, i, 375 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895); *Mast. in Fl. Cap.*, vii, 135 (1897): **Calorophus gracilis,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891).

Stems caespitose or occasionally sporadic on short creeping rhizomes, erect, erect-spreading or drooping in their upper parts, slender, terete, much branched from near the base upwards, obscurely striate or wrinkled, white-speckled, 2–4 dm. high; branches filiform, divided several times, faintly wrinkled and white-speckled; sheaths on the stems closely convolute, oblong-lanceolate, obtuse, slender-aristate, cartilaginous, thinner at the margins, prominently striate, red-brown, mostly 1–1·4 cm. long; sheaths on the branches smaller, white-speckled; male spikelets solitary at the apices of the branchlets, ovate to oblong, many-flowered, mostly 5–7 mm. long; spathes closely imbricate, ovate, obtuse, subulate-aristate, cartilaginous, membranous at the margins, 1·5 mm. long; bracts loosely imbricate, ovate, obtuse, subulate-mucronate, cartilaginous, 1·75–2 mm. long; perianth oblong, 1·25–1·5 mm. long; segments membranous, pale brown; the outer lateral navicular, linear, acute, minutely puberulus on the carina; the anterior linear, obtuse, usually with a slender mucro; inner segments linear-oblong, obtuse, equalling or slightly exceeding the outer; female spikelets solitary at the apices of the branchlets, oblong, cuneate at base, 3–4-flowered, 3·5–4 mm. long; spathes as in the male; bracts closely imbricate, ovate, subacute, subulate-mucronate, cartilaginous, membranous at the margins, pale brown, 1·75–2 mm. long; perianth oblong, 1·75 mm.

long; outer segments linear-oblong, obtuse, cartilaginous; the lateral scarcely navicular, with minute teeth on the midrib and margins; the anterior minutely dentate at the margins; inner segments broadly oblong, cuneate at base, rounded at the apex, membranous, minutely dentate at the margins, distinctly shorter than the outer; ovary oblong; styles 3, free.

South Africa: Cape Province—Cape Div.: mountains near Cape Town, *Zeyher*, 4347, ♂; on the Muizenberg, *Zeyher*, 4348*b*, ♂, *Bolus*, 4466, ♂, *MacOwan*, 1670, ♂; mountains above Simon's Town, *Ecklon and Zeyher*, ♂, *Schlechter*, 1199, ♂, *Pillans*, 3412, ♂ and ♀, 4358, ♂; mountains above Miller's Point, *Wolley-Dod*, 2833, ♂; Smidtswinkel Bay, *Wolley-Dod*, 2544, ♂.—Tulbagh Div.: mountains near Tulbagh, *MacOwan in Herb. Albany Museum*, ♂.

6. L. ejuncidus, *Pillans*, comb. nov.: **Restio ejuncidus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 2 (1900) !.

Stems erect, moderately branched, slender, terete, studded with whitish tubercles, 4–5 dm. high; sheaths tightly convolute, linear-oblong, acute, coriaceous, membranous at their margins, wrinkled, 1·5–2 cm. long, with two short membranous lobes at the apex and with a subulate awn, 5–7 mm. long; male spikelets 1–4, in linear spicate cymes, linear-oblong, somewhat compressed, many-flowered, 1·5–2 cm. long; spathes bract-like; bracts loosely imbricate, linear-lanceolate, acuminate, cartilaginous, pale reddish, 1–1·2 cm. long, with a very slender mucro; perianth stipitate, cuneate, 3–3·25 mm. long; outer segments linear-lanceolate, acute, cartilaginous, glabrous, pale; the inner linear-oblong, pale-membranous, equalling the outer; female spikelets 1–2, in spicate cymes, resembling the male, many-flowered, 1–1·3 cm. long; perianth on a short red stipe, obliquely cuneate, compressed, 2·25–2·5 mm. long; left outer segment navicular, cartilaginous, villous on the carina which is broadened near the apex into a narrow wing; right outer segment linear-oblong, acute, minutely pubescent on the midrib, membranous; anterior segment linear-oblong, obtuse; inner segments linear-oblong, obtuse or emarginate at the apex, pale-membranous, slightly exceeding the outer; ovary ovate, reddish; styles 3, free.

South Africa: Cape Province—Caledon Div.: mountains at Genadendal, *Schlechter*, 10321, ♂ and ♀.

7. L. distichus, *Pillans*, comb. nov.: **Restio distichus,** *Rottb., Programm.*, 11 (1772); *ejusd. Descr. et Icon.*, 6, tab. 2, fig. 5 (1773); *Poir. in Lam., Encycl. Meth.*, vi, 172 (1804), excl. syn. *L.*; *Willd., Sp. Pl.*, iv, pars 2, 725 (1806), excl. syn. *L.*; *Pers., Synops. Pl.*, ii, 607 (1807); *Spreng., Syst. Veg.*, i, 185 (1825); *Nees in Linnaea*, v, 637 (1830); *Kunth, Enum.*, iii, 409 (1841); *Drège, Zwei Pfl. Documente*, 88 (1844); *Steud., Synops. Pl.*, ii, 254 (1855); *Mast. in Linn. Soc. Journ.*, viii, 243 (1865); *Mast., op. cit.*, x, 279 (1868):

R. simplex, *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840), quoad infl., non *Thunberg*: **Thamnochortus punctulatus,** *Nees*, var. *gracilis* (*Nees*) *ex Drège in Linnaea*, xx, 242 (1847) !, excl. *Drège* No. 13, absque descript.: **Restio punctulatus,** *Nees ex Mast. in Journ. Linn. Soc.*, viii, 242 !; *Mast., op. cit.*, x, 279: **Thamnochortus distichus,** *Mast., op. cit.*, x, 233 !; *in DC. Monog. Phan.*, i, 326 (1878); *in Fl. Cap.*, vii, 128 (1897): **Staberoha disticha,** *Durand et Schinz, Consp. Fl. Afr.*, v, 520 (1895): **Thamnochortus membranaceus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 11 (1900) !.

Stems caespitose or sporadic, erect, sparingly or moderately branched, slender, wrinkled, white-spotted, 3–5 dm. high, about 1 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, subacute, slender-aristate, coriaceous deeply hyaline-membranous in the upper half, striate, 1·2–1·5 cm. long; male spikelets 1–5, adjacent in spicate cymes, erect, oblong, cuneate at base, many-flowered, about 1·5 cm. long; spathes resembling the uppermost sheaths, 1–1·2 cm. long; bracts loosely imbricate or erect-spreading, often leaving sections of the rhachilla exposed, oblong-lanceolate, acute, mucronulate, coriaceous, membranous at apex, 8–10 mm. long; perianth subsessile, cuneate-oblong, 4–5 mm. long; outer segments linear, obtuse, cartilaginous, equal; the lateral acutely angled on the dorsal side, glabrous or sparingly villous on the apical half; inner segments linear-oblong, obtuse, hyaline-membranous, distinctly shorter than the outer; female spikelets 1–3, adjacent in spicate cymes, linear-lanceolate to oblong, many-flowered, 1·2–1·5 cm. long; spathes as in the male; bracts loosely imbricate, oblong, coriaceous, tapered and membranous in their upper parts, mucronate, 8–10 mm. long; perianth shortly stipitate, cuneate-oblong, 3·5–3·75 mm. long; outer segments linear-oblong, rounded at the apex, cartilaginous, equal; the lateral with entire or lacerate wings; inner segments united at base, deltoid-lanceolate, acute, membranous, pale, with a broad red band down the lower half, distinctly shorter than the outer; ovary cuneate-oblong, compressed-triquetrous, with a hard flattened cap; styles 3, arising from the margin of the cap.

South Africa: Cape Province—Cape Div.: Table Mt., *Drège*, 64, ♂, *Pappe in Herb. Mus. Austr.-Afr.*, 13007, ♂; lower parts of Blinkwater Ravine, Table Mt., *Pillans*, 4296, ♂ and ♀.—Paarl Div.: French Hoek, *Alexander*, ♂; Bain's Kloof, *Schlechter*, 9096, ♂, 9097, ♀.—Tulbagh Div.: Witsen Berg and Skurfde Berg, *Zeyher*, 1737, ♂ and ♀.—Ceres Div.: Koude Bokkeveld, Skurfde Bergen, near Gydouw, *Schlechter*, 10011, ♂, 10012, ♀.—Riversdale Div.: lower part of Lange Bergen, near Kampsche Berg, *Burchell*, 7040, ♂; Garcia's Pass, *Bolus*, 11413, ♂.—Prince Albert Div.: Zwartberg Pass, *Bolus*, 11633, ♂.

8. L. Andreaeanus, *Pillans*, sp. nov.; culmis caespitosis erectis tenuis rugulosis infra medium parum ramosis; vaginis arcte convolutis oblongis

acutis subulato-mucronatis coriaceis subrufis; spiculis masculis oblongis 1–4 in cymas spiciformes vel racemiformes dispositis; bracteis erecto-patentibus ovatis vel ovato-oblongis acutis; perianthio sessili oblongo; segmentis hyalino-membranaceis, exterioribus linearibus acutis vel acuminatis, interioribus oblongis obtusis brevioribus; spiculis femineis paucis vel multis plurifloris oblongis in cymas spiciformes vel racemiformes dispositis; bracteis laxe imbricatis ovato-oblongis acutis; perianthio sessile lineari-cuneato trigono; segmentis membranaceis, exterioribus lateralibus linearibus parum villoso-carinatis, interioribus lineari-oblanceolatis obtusis brevioribus; ovario oblongo trigono corneo superne; stylis tribus basi connatis.

Stems caespitose, erect, slender in their upper parts, moderately branched from below the middle upwards, wiry, terete, rugulose with depressed obsolete tubercles, 3–7 dm. high; sheaths tightly convolute, oblong, acute, subulate-mucronate, coriaceous, red-brown, nervose and yellow-speckled on the lower half, mostly 1–1·5 cm. long, up to 1·8 cm.; male spikelets 1–3, in a spicate or racemose cyme, oblong, cuneate at base, many-flowered, 6–8 mm. long; spathes sheath-like but shorter; bracts widely spaced on a red rhachilla, erect-spreading, ovate-oblong to oblong, acute, mucronate, cartilaginous, ferruginous, 3·5–5 mm. long; perianth sessile, oblong, 2·5–3 mm. long; segments hyaline-membranous, pale; the outer linear, acute to acuminate, unequal; the inner oblong, obtuse, shorter than the outer; female spikelets few to many, in spicate or racemose cymes, oblong to linear-oblong, tapered at base, several-flowered, 6–8 mm. long; spathes closely embracing the spikelets, oblong, acute, aristate, cartilaginous, 7–9 mm. long; bracts loosely convolute, ovate-oblong, acute, mucronate, cartilaginous, ferruginous, 4·5–5 mm. long; perianth sessile, narrowly cuneate, triquetrous, 3–3·5 mm. long; segments membranous, pale; the outer lateral linear, apiculate, slightly villous-carinate; the anterior linear-oblong, obtuse; the inner linear-oblanceolate, obtuse, shorter than the outer-lateral; ovary oblong, triquetrous, surmounted by a narrower horny cap; styles 3, united at base to form a stylopod; nut narrow-elliptical, triquetrous, scabridous, purplish.

South Africa: Cape Province—Willowmore Div.: Aasvogelberg, *Andreae*, 967, ♂ and ♀, 975, ♂ and ♀ (type), 981*a*, ♂; mountains west of Miller Station, *Andreae*, 1026, ♀.

9. L. rigidus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 10 (1900) !.

Stems sporadic on creeping rhizomes, erect, moderately branched from below the middle upwards, wiry, rough with wrinkles and small tubercles, 3–6 dm. high, 1–1·25 mm. in diameter at the middle; sheaths closely convolute, lanceolate, obtuse, slender-aristate, soon lacerate, coriaceous in the lower half, white-membranous in the upper, mostly 1–2·5 cm. long;

male inflorescence spicate or narrow paniculate-cymose, usually 1–3 cm. long; spathes like the upper sheaths but smaller; spikelets few to many, oblong, many-flowered, 4–6 mm. long; bracts loosely convolute, oblong, acute, subulate-mucronate, cartilaginous, 2·5–3 mm. long; perianth oblong, compressed, 2 mm. long; outer segments linear, acute, thinly cartilaginous, glabrous or the lateral minutely villous below the apex, subequal; the lateral carinate; inner segments linear-oblong, obtuse, membranous, distinctly shorter than the outer; female inflorescence spiciform, usually 2–4 cm. long; spathes as in the male but longer; spikelets 2–6, lanceolate to oblong or narrow-cuneate, 1–3-flowered, 5–10 mm. long; bracts loosely convolute, oblong, acute, subulate-mucronate, cartilaginous, 3·5–4·5 mm. long; perianth oblong, 3-sided, 2·5–3 mm. long; outer segments obtuse, cartilaginous, reddish, equal; the lateral linear-oblong, emarginate at apex, carinate, minutely puberulous on the carina; the anterior linear; inner segments lanceolate, subacute or obtuse, membranous, equalling or slightly exceeding the outer; ovary oblong, tapered at both ends, distinctly 3-angled; styles 3, free.

South Africa: Cape Province—Ceres Div.: Cold Bokkeveld, *Schlechter*, 8882, ♂, 8883, ♀.—Laingsburg Div.: Witteberg, above Whitehill, *Compton in Bolus Herb.*, 18312, ♂, 18313, ♂ and ♀.

10. L. Burchellii, *Mast. in Journ. Linn. Soc.*, x, 222 (1868)!; *in DC. Monog. Phan.*, i, 331 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 517 (1895); *Mast. in Fl. Cap.*, vii, 117 (1897).

Stems sporadic on creeping rhizomes, erect, sparingly to much branched, slender, terete, studded with whitish tubercles, 3–6 dm. high; sheaths loosely convolute, oblong-lanceolate, acute, subulate-mucronate, coriaceous, striate, purple-brown, whitish-spotted, thinner and paler at the margins, 0·5–1·5 cm. long; male spikelets 1–5, in spicate cymes, oblong, acute, many-flowered, 1–1·5 cm. long; spathes sheath-like but smaller; bracts loosely imbricate, oblong, acute, mucronulate, cartilaginous, red-brown, 4–5 mm. long; perianth sessile, ovate-oblong, 3 mm. long; segments oblong-lanceolate, obtuse, chartaceous, glabrous, pale, streaked red-brown, subequal; the outer lateral navicular, carinate; female spikelets 1–5, in spicate cymes, oblong-lanceolate, many-flowered, about 1 cm. long; spathes sheath-like but smaller; bracts closely convolute, oblong, acute, mucronulate, cartilaginous, about 6 mm. long; perianth sessile, linear or oblong-cuneate, trigonous, 3–4 mm. long; segments oblanceolate, cartilaginous, pale, with red-brown streaks; the outer lateral carinate, acute, apiculate, slightly longer than the others; inner segments obtuse, often lacerate at the upper margins; ovary oblong or narrowed towards the base, trigonous, smooth; styles 3, united at base into a hard stylopodium.

South Africa: Cape Province—Swellendam Div.: between Vet River

and Krombeks River, *Burchell*, 7185, ♂ and ♀.—RIVERSDALE DIV.: foot of Lange Bergen, near Kampsche Berg, *Burchell*, 7146, ♂; near Riversdale, *Muir*, 3088, ♂, 3090, ♀; near Albertinia, *Muir*, 1345, ♀.—GEORGE DIV.: Wolf Drift on Maalgat River, *Burchell*, 6101, ♂ and ♀.

11. L. rigoratus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 9 (1900) !.

Stems caespitose, erect, slender, terete, rugulose, branched from below the middle upwards, usually 4–5 dm. high; sheaths erect, closely or loosely embracing the stem, oblong or ovate-oblong, obtuse, with an erect-spreading mucro, coriaceous, nervose, about 1 cm. long; female spikelets many, in panicled or spicate cymes, oblong or cuneate-oblong, several-flowered, 7–10 mm. long; spathes sheath-like; bracts ovate or oblong-ovate, acute, mucronate or mucronulate, cartilaginous, 4–6 mm. long; perianth subsessile, elliptic or cuneate-oblong, 2–2·5 mm. long; segments obtuse, membranous; the outer lateral linear-oblong, carinate, villous along the entire length of the keel; anterior segment linear-oblong or linear-oblanceolate, villous on the lower parts of its dorsal surface or glabrous, sometimes distinctly smaller than the others; inner segments oblanceolate, dentate at the upper margins, villous on their lower parts, slightly longer than the outer; ovary oblong, subtrigonous; styles 3, united at base to form a hard stylopodium; fruit elliptic, trigonous, smooth.

South Africa: Cape Province—CAPE DIV.: north end of Camp Ground, Mowbray, *Pillans*, 3391, ♀.—STELLENBOSCH DIV.: flats between the Strand and Eerste River, *Pillans*, 4908, ♀.—BREDASDORP DIV.: Vogel Vley, *Schlechter*, 10490, ♀.

Var. β, simulans (*Pillans*); spathe about $\frac{3}{4}$ the length of the spikelet; spikelets smaller than in the species; outer lateral segments acute.

Cape Province—STELLENBOSCH DIV.: flats between the Strand and Eerste River, *Pillans*, 4909, ♀.

The variety was found growing with the species and showed a slight difference in appearance.

12. L. fruticosus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 9 (1900) !.

Stems arising from creeping rhizomes, erect, branched above the middle, terete, finely wrinkled and minutely white-speckled, slender, about 3 dm. high; sheaths loosely embracing the stem, ovate-oblong, obtuse or subacute, subulate-mucronate, coriaceous, usually 1–1·5 cm. long; male spikelets in spicate or racemose cymes, ovate, about 1 cm. long; bracts loosely imbricate, ovate, acute, mucronate, cartilaginous, 5–6 mm. long; perianth sessile, elliptic, compressed, about 3 mm. long; segments membranous; the outer lateral linear, navicular, setaceo-scabrid on the midrib; anterior segment acicular, usually much shorter than the others; inner segments elliptic-oblong, dentate at apex, often with their margins infolded, shorter than or equalling the outer lateral; female spikelets in spicate

cymes, oblong, subtended by a sheath-like spathe, about 8 mm. long; bracts as in the male but more imbricate and thicker; perianth sessile, linear, becoming narrowly cuneate, about 4 mm. long; segments linear, acute, cartilaginous, glabrous, equal; ovary elliptic-oblong, trigonous; styles 3, united at base into a hard stylopodium.

South Africa: Cape Province—Bredasdorp Div.: Ratel River, *Schlechter*, 9717, ♂, 9718, ♀.

13. L. Marlothii, *Pillans*, sp. nov.; culmis erectis teretibus paulo gracilibus rugulosis sparsim ramosis vel simplicibus; vaginis oblongis vel elliptico-oblongis obtusis vel subacutis subulato-mucronatis cartilagineis basi arcte convolutis superne paulo expansis erecto-patentibus; spiculis femineis multis oblongis in cymas racemosas vel spiciformes dispositis; spathis vaginiformibus; bracteis ovatis subacutis mucronatis cartilagineis; perianthio sessili oblongo-lanceolato vel cuneato-oblongo; segmentis oblongo-lanceolatis obtusissimus, exterioribus lateralibus mediano nervo vel basi sparsim papilliformi-villosis vel glabris, interioribus glabris longioribus; ovario elliptico-oblongo trigono; stylis tribus liberis.

Stems arising from creeping rhizomes, erect, wiry, rather slender in their upper parts, terete, rugulose, sparingly branched or simple, 4–8 dm. high; sheaths with the base embracing the stem, expanding and erect-spreading upwards, oblong or elliptic-oblong, obtuse or subacute, subulate-mucronate, cartilaginous, usually 1·5–2 cm. long; female spikelets many, in a racemose or spiciform inflorescence, oblong, several-flowered, 8–10 mm. long; spathes sheath-like; bracts ovate, subacute, mucronate, cartilaginous, 6–7 mm. long; perianth sessile, oblong or cuneate-oblong, 3·5–4 mm. long; segments oblong-lanceolate, very obtuse; the outer lateral with a few papilliform hairs on the rather prominent midrib, or at the base or glabrous; inner segments glabrous, longer than the outer; ovary elliptic-oblong, trigonous; styles 3, thickened and merged at base into a hard stylopodium.

South Africa: Cape Province—Ceres Div.: Vaalkloof, near Karroopoort, *Marloth*, 9102, ♀ (type).—Worcester Div.: Touws River, *Marloth*, 3153, ♀; summit of the Tafelberg, *Pillans in Bolus Herb.*, 14138, ♀.

14. L. Muirii, *Pillans*, sp. nov.; culmis ramosis vel simplicibus rugulosis albido-maculosis; vaginis laxe convolutis, in partibus superioribus interdum erecto-patentibus, ovato-oblongis vel oblongo-lanceolatis acutis mucronatis; spiculis masculis ovatis vel oblongis in cymam paniculatam vel spicatam dispositis; spathis vaginiformibus; bracteis laxe imbricatis ovatis acutis mucronatis cartilagineis; perianthio sessili elliptico; segmentis membranaceis, exterioribus lateralibus linearibus acutis, antico nullo, interioribus oblongis obtusis; spiculis femineis multis oblongis vel lanceolatis in paniculatam vel racemosam cymam dispositis; spathis vaginiformibus; bracteis imbricatis ovatis acutis mucronatis cartilagineis;

perianthio sessili auguste cuneato; segmentis exterioribus lateralibus lineari-oblongis acutis carinatis cartilagineis, in carina glabra vel pilis papilliformibus, antico oblongo-lanceolatis obtusis, interioribus oblanceolatis apici obtusissimus; ovario cuneato-oblongo trigono uniloculari; stylis 3 ad basem connatis.

Stems arising from creeping rhizomes, erect, stout in their lower parts, slender in their upper, moderately branched from about the middle upwards or simple, terete, rugulose, minutely white-speckled, 6–10 dm. high; sheaths loosely embracing the stem, sometimes erect-spreading in their upper parts, ovate-oblong or oblong-lanceolate, acute, with a deciduous mucro, coriaceous, chartaceous at the margins, nervose, yellow-speckled, mostly 2–4 cm. long; male spikelets many, in panicled or spicate cymes, ovate or oblong, 1–1·5 cm. long; spathes sheath-like but smaller and thinner; bracts distinctly spaced on the rhachis of the spikelet, loosely imbricate, ovate, acute, mucronate, cartilaginous, 4·5–6 mm. long; perianth sessile, elliptic, 3 mm. long; segments membranous; the outer lateral linear, acute, laterally compressed, with a few minute hairs on the midrib; anterior segment absent; inner segments oblong, obtuse, about equal with the outer; female spikelets many, in panicled or racemose cymes, oblong or lanceolate, several-flowered, 8–12 mm. long; spathes sheath-like; bracts rather closely imbricate, ovate, acute, mucronate, cartilaginous, 6–8 mm. long; perianth sessile, narrowly cuneate, about 5 mm. long; outer lateral segments linear-oblong, acute, carinate, cartilaginous, glabrous or with papilliform hairs on the carina, longer than the others; anterior segment oblong-lanceolate, obtuse; inner segments oblanceolate, rounded and toothed at the apex; ovary cuneate-oblong, trigonous; styles 3, united at base to form a horny stylopodium.

South Africa: Cape Province—RIVERSDALE DIV.: north end of Garcia's Pass, *Muir*, 3178, ♂, 3179, ♀ (types); Phisantefontein, north slopes of Lange Bergen, *Muir*, 3197, ♂, 3198, ♀.

Superficially this species is distinguished from *L. vimineus*, Pillans, its nearest ally, in having stouter stems and more numerous spikelets produced in larger inflorescences in both sexes.

15. L. vimineus, *Pillans*, comb. nov.: **Restio vimineus,** *Rottb., Programm.*, p. 10 (1772); *ejusd. Descr. et. Icon.*, p. 4, tab. 2, fig. 1 (1773); *Linn., Syst. Veg.*, ed. 13, p. 738 (1774); ed. 14, p. 881 (1784); ed. 15, p. 924 (1797); *Poir. in Lam., Encycl. Meth.*, vi, 167 (1804), excl. syn. omn. praeter *Rottb.*; *Steud. in Flora*, 1829, i, 134; *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840); *Mast. in Journ. Linn. Soc.*, viii, 254 (1865): **R. pauciflorus,** *Poir., op. cit.*, 168!; *Kunth, Enum.*, iii, 412 (1841); *Steud., Synops. Pl.*, ii, 254 (1855); *Mast., op. cit.*, 225, 254; *in DC. Monog. Phan.*, i, 235 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 509 (1895); *Mast. in Fl. Cap.*, vii, 66 (1897):

R. incurvatus, *Nees in Linnaea*, v, 642 (1830) !, non *Thunb.*, excl. cit. omn. ; vii, 616 (1832) : **Calopsis festucacea,** *Kunth, op. cit.*, 425 ! ; *Drège, Zwei Pfl. Doc.*, 109, 110 (1844) ; *Steud., op. cit.*, 258 : **C. peronata,** *Kunth, op. cit.*, 426 ! quoad pl. fem. ; *Drège, op. cit.*, 70, 71 ; *Steud., loc. cit.* : **C. incurvata,** *Kunth, op. cit.*, 427 !, partim, excl. syn. *R. incurvatus, Thunb.* ; *Drège, op. cit.*, 67, 74 ; *Steud., loc. cit.* : **C. oxylepis,** *Kunth, loc. cit.* ! ; *Drège, op. cit.*, 74 ; *Steud., loc. cit.* : **Restio oxylepis,** *Kunth, loc. cit.* !, nomen : **R. incurvatus,** *Kunth ex Drège in Linnaea*, xx, 240 (1847) !, absque descript. : **R. incurvatus,** var. **bracteata,** *Nees ex Drège, op. cit.*, 241 !, absque descript. : **R. incurvatus,** var. **lepida,** *Nees ex Drège, loc. cit.* !, absque descript. : **Leptocarpus incurvatus,** *Mast. in Journ. Linn. Soc.*, x, 223 (1868) !, excl. syn. *R. incurvatus, Thunb.* ; *in DC. Monog. Phan.*, i, 332, excl. syn. praeced. ; *Durand et Schinz, op. cit.*, 517, excl. syn. praeced. ; *Mast. in Fl. Cap.*, vii, 118, excl. syn. praeced. : **L. oxylepis,** *Mast. in Journ. Linn. Soc.*, x, 223 ! ; *in DC. Monog. Phan.*, i, 332 ; *Durand et Schinz, op. cit.*, 518 ; *Mast. in Fl. Cap.*, vii, 118 : **L. peronatus,** *Mast. in Journ. Linn. Soc.*, x, 224 ! ; *in DC. Monog. Phan.*, i, 333 ; *Durand et Schinz, op. cit.*, 518, excl. syn. var. *hirtellus* ; *Mast. in Fl. Cap.*, vii, 118 : **L. festucaceus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 8 (1900) !.

Stems arising from creeping rhizomes or occasionally caespitose, erect, moderately branched or simple, rigid at base, slender or wiry in upper parts, terete, wrinkled or rugulose, sometimes thinly velvety pubescent on their lower parts, usually 3–6 dm., up to 8 dm., high ; sheaths in their lower parts loosely embracing the stem, gradually expanding and erect-spreading upwards, ovate, ovate-oblong or lanceolate-oblong, acute or obtuse, mucronate, coriaceous, thinner at the margins, dorsally nervose, usually 1–1·5 cm., up to 2 cm., long ; male spikelets in racemose, paniculate or spicate cymes, ovate or oblong, many-flowered, 6–12 mm. long ; spathes sheath-like ; bracts loosely imbricate or erect-spreading, ovate or ovate-oblong, acute or obtuse, mucronate or mucronulate, cartilaginous, thinner at the margins, about 4 mm. long ; perianth oblong, about 2·75 mm. long ; segments hyaline-membranous ; the outer lateral linear-oblong, obtuse, villous-carinate ; the anterior linear or linear-spathulate, acute or obtuse, half as long as or equalling the inner ; inner segments linear-oblong, obtuse, with involute margins, slightly shorter than or equalling the outer lateral ; female spikelets many or few, in racemose, spicate or panicled cymes, linear-oblong, several- to many-flowered, about 1 cm. long ; spathes sheath-like but erect ; bracts imbricate, ovate, acute, mucronate or mucronulate, cartilaginous, 5–8 mm. long ; perianth subsessile, oblong or cuneate-oblong, trigonous, usually 3–3·5 mm. long ; segments membranous ; the outer lateral oblanceolate or oblong-lanceolate, obtuse or acute, densely villous on the dorsal surface of the midrib ; anterior segment oblong-

lanceolate or somewhat spathulate, villous on the lower parts of its dorsal surface or glabrous; inner segments oblanceolate, very obtuse at apex, villous on the lower parts of the midrib or glabrous, rarely villous to the apex, shorter to longer than the outer; ovary oblong, trigonous; styles 3, arising from a firm stylopodium, free; fruit elliptic-oblong, trigonous, smooth.

South Africa: without precise locality, in Lamarck Herbarium, collector unknown, ♂, *Oldenburg*, ♂, *Wallich*, ♂, *Ecklon*, 320 partly, *Harvey*, 364, ♂ and ♀, *Drège*, 63*b*, ♂, *Pappe*, 99, ♂, *Reichenbach*, ♂, *Bachmann*, 445, ♀.

Cape Province—Cape Div.: Table Mt., *R. and T. Fries*, 3091, ♂, *Otto Kuntze*, ♀; Devil's Peak, *Ecklon*, 847, ♂; Lion's Head, *Ecklon and Zeyher*, ♂, *Pillans*, 3389, ♂, 3390, ♀, 4352, ♀; slopes above Cape Town, *Marloth*, ♂ and ♀; Wynberg Hill, *Pillans*, 4349, ♂; Hout Bay, *Schlechter*, 1228, ♂ and ♀; Constantia Berg, *Schlechter*, 541, ♂; Noah's Ark Battery, Simon's Town, *Wolley-Dod*, 2807, ♂; Chapman's Peak, *Pillans*, 4343, ♀; Cape Flats, near Rondebosch, *Burchell*, 832, ♀; False Bay, *Robertson*, ♂ and ♀.—Stellenbosch Div.: Stellenbosch, *Duthie*, 789, ♂ and ♀; Sir Lowry's Pass, *Schlechter*, 7298, ♂.—Caledon Div.: Zwartberg, *Pappe in Herb. Mus. Austr.-Afr.*, 12877, ♂, *Guthrie in Bolus Herb.*, 16014, ♀, 16182, ♂ and ♀; between Villiersdorp and French Hoek, *Bolus*, 7449, ♂.—Tulbagh Div.: near Tulbagh Waterfall, *Bolus*, 7498, ♂, Tulbagh, *MacOwan*, 3078, ♂.—Ceres Div.: Bokkeveld, *Drège*, 55, ♀; Ceres, *Bolus*, 7457, ♂; Mitchell's Pass, *Bolus*, 9666, ♂; Hottentots Kloof, *Pearson in Sladen Mem. Exped.*, 4908, ♂.—Piquetberg Div.: on the Piquetberg, *Schlechter*, 5250, ♂; Piquiniers Kloof, *Schlechter*, 7953, ♂, 7954, ♀.—Clanwilliam Div.: between Lange Vley and Heerenlogement, *Drège*, 2481, ♀; Cedar Berg, on sandy flats near Ezelsbank, *Drège*, 39, ♂ and ♀, 2501, ♂; Cedar Berg, *Drège*, 2497, ♀; Blauwberg, *Schlechter*, 8454, ♀.—Van Rhyn's Dorp Div.: Groene River and Waterval, *Drège*, 38; between Grasberg River and Waterval, *Drège*, 2499 partly, ♀, 2500 partly, ♂.—Little Namaqualand: Kamiesberg, *Drège*, 68*a*, ♂.—Riversdale Div.: Melkhoutfontein, *Muir*, 3105, ♂.—Port Elizabeth Div.: Walmer, *Paterson*, 2559, ♂.

Var β, hirtellus (*Pillans*): **Calopsis hirtella,** *Kunth, Enum.*, iii, 426!; *Drège, Zwei Pfl. Documente*, 70; *Steud., Synops. Pl.*, ii, 258: **Leptocarpus peronatus,** *Mast.* var. *hirtellus*, *Mast. in Journ. Linn. Soc.*, x, 224!; in *DC. Monog. Phan.*, i, 334; *Durand et Schinz, Consp. Fl. Afr.*, v, 518; *Mast. in Fl. Cap.*, vii, 119: stems and branches clothed with velvety pubescence.

Cape Province—Caledon Div.: Zwart Berg, *Guthrie in Bolus Herb.*, 16015, ♂, 16180, ♂ and ♀.—Bredasdorp Div.: hills near Mierkraal, *Schlechter*, 10699, ♀.—Van Rhyn's Dorp Div.: between Grasberg River and Waterval, *Drège*, 2499 partly, ♀, 2500 partly, ♂.

Retarded stems are often produced by plants of this species as a result of burning or grazing : though flowering they possess a distinct appearance by reason of their being dwarfed and much curved.

16. L. paniculatus, *Mast. in Journ. Linn. Soc.*, x, 221 (1868) !, excl. syn. *Restio fruticosus* ; *in DC. Monog. Phan.*, i, 330 (1878), excl. syn. idem ; *Durand et Schinz, Consp. Fl. Afr.*, v, 518 (1895), excl. syn. idem ; *Mast in Fl. Cap.*, vii, 116 (1897), excl. syn. idem : **Restio paniculatus,** *Rottb., Program.*, p. 10 (1772) ; *ejusd. Descr. et Icon.*, p. 4, tab. 2, fig. 3 (1773) ; *Linn., Syst. Veg.*, ed. 13, 738 (1774) ; *Linn., op. cit.*, ed. 14, 881 (1784) ; *Thunb., Diss.*, p. 20 (1788) ! ; *in Usteri, Delect.*, i, 55 (1790) ; *ejusd. Prodr. Cap.*, 16 (1794) ; *Linn., Syst. Veg.*, ed. 15, p. 924 (1797) ; *Poir. in Lam., Encycl. Meth.*, vi, 168 (1804) ; *Willd., Sp. Pl.*, iv, pars 2, p. 728 (1806) ; *Pers., Syn. Pl.*, ii, 607 (1807) ; *Thunb., Fl. Cap.*, ed. 1, p. 339 (1811) ; ed. *Schultes*, p. 89 (1823) ; *Spreng., Syst. Veg.*, i, 186 (1825) ; *Nees in Linnaea*, v, 643 (1830) ; *Nees, op. cit.*, vii, 616 (1832), excl. syn. *R. fruticosus* ; *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840) ; *Drège in Linnaea*, xx, 240 (1847) ; *Mast. in Journ. Linn. Soc.*, xiv, 419 (1875) ; *op. cit.*, xxi, 590, No. 7 (1885) : **Calopsis paniculata,** *Desvaux in Ann. Sc. Nat.*, xiii, 44, tab. 3, fig. 2 (1828) ; *Kunth, Enum.*, iii, 421 (1841), excl. syn. *R. fruticosus* ! ; *Drège, Zwei Pfl. Documente*, 87 (1844) ; *in Linnaea*, xx, 240 ; *Steud., Synops. Pl.*, ii, 257 (1855) : **Restio fruticosus,** *Steud. in Flora*, 1829, i, 134, non *Thunberg* : **R. ramiflorus,** *Nees in Linnaea*, v, 644 (1830) ! : **Calopsis ramiflora,** *Kunth, Enum.*, iii, 423 (1841) ! ; *Steud., Synops. Pl.*, ii, 257 : **Restio pondoensis,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 5 (1900) !.

Stems sporadic along stout creeping rhizomes, erect, rigid, and stout in their lower parts, simple and terete in their lower parts, much branched and angular in their upper, smooth, minutely purple-speckled, 1–2 m. high, about 5 mm. in diameter in the lower parts ; barren stems and branches often plentiful, much divided into filiform branchlets ; sheaths on the stems closely convolute, oblong, acuminate, aristate, coriaceous, with deciduous, broad, membranous margins, striate, red-brown, about 3 cm. long ; sheaths on the ultimate branchlets about 2 mm. long, white-speckled, with long, foliaceous awns and a pair of white-membranous lobes on the upper margin ; male inflorescence a much branched panicle, plume-like, mostly 1·5–2 dm. long, up to 3 dm. ; spathes at the base of the spikelets oblong, acuminate, aristate, lacerate and white-membranous at the margins, 1·5–2 mm. long ; spikelets very numerous, erect to spreading, ovate-oblong, tapered at the base, many-flowered, 4–7 mm. long ; bracts loosely imbricate, ovate-oblong, subacute or acute, minutely apiculate or muticous, cartilaginous, white-membranous at the margins, 2·5 mm. long ; perianth shortly stipitate, ovate-oblong, 1·75–2·5 mm. long ; outer segments linear-oblong, acute, cartilaginous ; the lateral carinate, minutely puberulous on the upper half

of the carina; inner segments linear, obtuse, membranous, distinctly shorter than the outer; female inflorescence like the male, spathes and spikelets as in the male; bracts as in the male but 2–2·5 mm. long; perianth shortly stipitate, partly protruding beyond the apex and on either side of the bract, ovate-oblong, subtrigonous, dorsally compressed, 2·5–3 mm. long; outer segments linear-oblong, acute, cartilaginous; the lateral navicular, minutely puberulus on the carina; inner segments linear-oblong, obtuse, membranous, slightly shorter than the outer; ovary ovate-oblong, trigonous; styles 3, free.

South Africa: without precise locality, *Oldenburg*, 160, ♂, *Thunberg*, ♂, *Burchell*, 5813, ♂, *Dr. Maton, Thom*, ♂, *Forster*, ♀, *Mund*, ♂ and ♀, *Bowie*, ♂.

Cape Province—Cape Div.: Table Mt., *Ecklon*, 849, ♂, *Scott-Elliot*, 140, ♂, *Pillans*, 4342, ♂ and ♀; vicinity of Cape Town, *Burchell*, 405, ♀; above Camp's Bay, *Moss*, 7835, ♂; Kirstenbosch, *Page in Bolus Herb.*, 14336, ♂ and ♀; Hout Bay, *Bolus*, 7227, ♂; slopes of Steenberg, *Pillans*, 4344, ♂; Cape Flats, *Ecklon*, 568, ♀.—Stellenbosch Div.: Sir Lowry's Pass, *O. Kuntze*, ♂, *Burtt-Davy*, 12529.—Paarl Div.: Paarl Mountains, *Drège*, 167*a*, 167*b*, ♂; Dal Josephat, *Tyson*, 830, ♂.—Ceres Div.: Matroosberg, *Phillips*, 2115, ♂.—Caledon Div.: Caledon, *Alexander*, ♀; Houwhoek, *MacOwan in Herb. Austr.-Afr.*, 1667, ♀.—Riversdale Div.: Phisantefontein, north slopes of Lange Bergen, *Muir*, 3203, ♂.—Mossel Bay Div.: Lange Bergen at Koega, *Muir*, 1466, ♀.—George Div.: near George, *Schlechter*, 2541, ♀.—Knysna Div.: near Portland River, *Duthie*, 937.—Uniondale Div.: near Haarlem, *Schönland*, 3093, ♀.—Humansdorp Div.: Witte Els Bosch, *Fourcade*, 2204, ♂ and ♀.—Port Elizabeth Div.: Van Staden's, *Paterson*, 2477, ♀; Zwartkops River, *Ecklon*, 540, ♂, 789, 922, ♂, *Zeyher*, 4346, ♀.—Albany Div.: near Graham's Town, *Ecklon*, 922, ♂; Stone's Hill, *Salisbury*, ♀; Cold Spring, *Rogers*, 4444, ♂; Howison's Poort, *Scott-Elliot*, 779, ♂, *Rogers*, 3425, ♂.—Victoria East Div.: Hogsback, *Rattray*.—King William's Town Div.: Perie, *Sim*, 1320, ♀; summit of Perie Mountains, *Galpin*, 5943, ♀.—Tembuland: Bazeia, *Bauer*, 506, ♀.

Pondoland: without precise locality, *Bachmann*, 342, ♂; Maqua Falls, Egossa, *Sim*, 2493, ♀.

Natal: Bevaan Falls, *Wood*, 3195, ♂; Umbumbulu, *Wood*, 9597, ♂; Dumisa (Alexandra County), *Rudatis*, 1012, ♀.

V, THAMNOCHORTUS, *Bergius, Fl. Cap.*, 353, tab. v, fig. 8 (1767); *R. Br., Prodr. Fl. Nov. Holl.*, 244 (1810); *Linn., Syst. Veg.*, ed. 16, i, p. 129 (1825); *Endl., Gen. Pl.*, 122 (1836); *Kunth, Enum.*, iii, 428 (1841); *Meisner, Gen. Pl.*, 408 (1842); *Endl., Gen. Pl.*, Suppl. 2, p. 11 (1842); *Steud., Synops. Pl.*, ii, 258 (1855); *Harv., Gen. S. Afr. Pl.*, ed. 2, p. 414 (1868); *Mast. in DC. Monog. Phan.*, i, 314 (partim), tab. ii, figs. 16–27, tab. v,

figs. 8*a*, 8*b* (1878); *Benth. et Hook, Gen. Pl.*, iii, 1034 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 9 (1888); *Mast. in Fl. Cap.*, vii, 119 (1897).

Flowers dioecious. Male spikelets many in panicled cymes, often declinate, usually oblong, many-flowered. Perianth compressed; segments 6, the outer lateral navicular, carinate along the median nerve, usually longer than the inner. Anthers linear-oblong, tapered above the middle into an apiculus. Rudimentary ovary with 1 style or absent. Female spikelets many in panicled cymes, few in spicate cymes or solitary and terminal, erect, larger than the male, many-flowered, with few empty bracts. Perianth subtrigonous or compressed; segments 6, the outer lateral navicular, keeled or winged along the median nerve. Staminodes tongue-shaped, short, or absent. Ovary compressed or subtrigonous, 1-celled; style solitary, simple. Fruit subtrigonous or compressed, indehiscent.

Flowering stems tufted or on creeping rhizomes, erect, simple or with fertile or barren branches, terete. Leaf-sheaths closely convolute or loose in parts, persistent. Much-branched, weaker and shorter barren stems are often present.

The genus is endemic.

Key based on Characters in the Female Plants.

* Stems velvety-pubescent:
Perianth orbicular; wings of outer-lateral segments distinctly protruding from behind the sides of the bracts . . . . . (1) *fruticosus.*
Perianth elliptic or rotundate; wings of outer-lateral segments occasionally slightly protruding from behind the sides of the bracts . . . . (2) *argenteus.*
** Stems glabrous or papillose:
† Perianth elliptic, ovate- or obovate-elliptic, usually somewhat cuneate at base; the outer-lateral segments keeled:
Flowering stems bearing branches concurrently with the production of flowers, rarely without branches:
Branches usually fascicled, sterile, much divided into filiform branchlets, (3) *glaber.*
Branches solitary, many fertile, simple . . . . . (4) *Levynsiae.*
Flowering stems not bearing branches concurrently with the production of flowers:
Stems papillose, at least on their lower parts . . . (12) *Guthrieae.*
Stems not papillose:
Bracts aristate; inner perianth-segments distinctly united at base, (14) *dumosus.*
Bracts not aristate; inner perianth-segments not distinctly united at base:
Outer perianth-segments decurrent on the stipe and leaving three vertical slits between their margins upon the stipe:
Perianth 3·5–4 mm. long; outer-lateral segments narrowed at apex, (10) *fraternus.*
Perianth 4·5–6 mm. long; outer-lateral segments scarcely narrowed at apex. . . . . (9) *paniculatus.*

Outer perianth-segments, if decurrent, not leaving three vertical slits between their margins on the stipe, but occasionally leaving one on its adaxial side :

Outer-lateral perianth-segments, together with the keel, obviously broadest at or shortly below the middle as seen in side view :

Stems rigid, smooth ; keel on the outer-lateral perianth-segments opaque, except at base . . . . . (6) *Muiri*.

Stems slender, scabrid ; keel on the outer-lateral perianth-segments hyaline-membranous . . . . . (7) *scabridus*.

Outer-lateral perianth-segments, together with the keel not obviously broadest at any part as seen in side view . . (8) *ellipticus*.

†† Perianth rotundate, obovate-rotundate, orbicular or ovate-orbicular ; the outer-lateral segments mostly winged :

Wing of outer-lateral perianth-segments 2·5–3 mm. in diam. . (15) *platypteris*.

Wing of outer-lateral perianth-segments not exceeding 2 mm. in diam. :

Stems rugulose, with sunken brown spots which are often accompanied with brown furrows . . . . . (18) *punctatus*.

Stems smooth or occasionally drying sulcate, white speckled :

Perianth rotundate, broadest at or shortly above the middle ; wing of outer-lateral perianth-segments not broader than the body of the segment as seen in side view :

Spikelets solitary or occasionally geminate in spicate cymes, (13) *Schlechteri*.

Spikelets many in paniculate or less often in spicate cymes :

Perianth 2·5 mm. long . . . . . (11) *pluristachyus*.

Perianth 3·5–3·75 mm. long . . . . . (5) *nutans*.

Perianth orbicular, usually broadest below the middle or less often at the middle ; wing of outer-lateral perianth-segments broader than the body of the segment as seen in side view :

Stems stout, at least in their lower parts ; inflorescence mostly exceeding 1 dm. in length, bearing several comparatively long branches :

Upper parts of perianth-wings hidden or occasionally some protruding from behind the sides of the bracts . . . (22) *insignis*.

Upper parts of perianth-wings conspicuously protruding from behind the sides of the bracts :

Spikelets ovate, obovate or rotundate, light brown, 1·2–2 cm. long, (21) *erectus*.

Spikelets elliptic-oblong or ovate-oblong, dark-brown, 1·5–2·5 cm. long, (23) *spicigerus*.

Stems slender ; inflorescence mostly less than or rarely attaining 1 dm. in length, sparsely and shortly branched or spicate :

Stems drying sulcate along their entire length . . (16) *Bachmannii*.

Stems not drying sulcate along their entire length :

Flowering stems simple and with flowering branches on the same plant, (20) *gracilis*.

Flowering stems never bearing flowering branches :

Bracts 1–1·5 cm. long ; perianth-segments conspicuously pale at their upper margins. . . . . (17) *Stokoei*.

Bracts 0·7–1 cm. long ; perianth-segments not or at most indistinctly pale at their upper margins . . . . (19) *dichotomus*.

1. T. fruticosus, *Bergius, Fl. Cap.*, 353, t. 5, fig. 8 (1767) ; *Mast. in Journ. Linn. Soc.*, x, 229 (1868), excl. var. *glaber* ; *in DC. Monog. Phan.*, i, 316 (1878), excl. var. ; *Durand et Schinz, Consp. Fl. Afr.*, v, 519 (1895), excl. var. ; *Mast. in Fl. Cap.*, vii, 122 (1897), excl. var. ; *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900) : **Restio dichotomus,** *Linn., Syst. Nat.*, ed. 12, ii, 735 (1767) : **R. scariosus,** *Thunb., Diss.*, 15 (1788) ! ; *in Usteri, Delect.*, i, 49 (1790) ; *ejusd. Prodr. Cap.*, 15 (1794) ; *Poir. in Lam., Encycl. Meth.*, vi, 173 (1804) ; *Willd., Sp. Pl.*, iv, pars 2, p. 723 (1806) ; *Thunb., Fl. Cap.*, ed. 1, p. 327 (1811) ; ed. *Schultes*, 86 (1823) ; *Nees in Linnaea*, v, 650 (1830) ; vii, 617 (1832) : **T. scariosus,** *R. Br., Prodr. Fl. Nov. Holl.*, in adnot. (1810) ; *Spreng., Syst. Veg.*, i, 188 (1825) ; *Kunth, Enum.*, iii, 430 (1841) ; *Drège, Zwei Pfl. Doc.*, 111 (1844) ; *Steud., Synops. Pl.*, ii, 259 (1855) : **R. velutinus,** *Nees ex Drège in Linnaea*, xx, 241 (1847) !, absque descript. : **R. vimineus,** *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 45 (1875) !, non *T. argenteus, Mast.* : **R. Thamnochortus,** *Thunb. Herb. ex Mast., loc. cit.*, No. 48 !.

Stems sporadic or caespitose, erect, simple or with tufts of slender barren branchlets, velvety pubescent, 3–6 dm. high, about 2 mm. in diameter at the middle ; sheaths at first closely convolute, becoming loose, at least in their upper parts, oblong-lanceolate, acute, mucronate or aristate, chartaceous or membranous, striate, glabrous or velvety pubescent on the lower parts, pale, mostly 4–8 cm. long, up to 1·2 dm. ; barren stems often abundant, bearing tufts of slender branchlets with foliaceous sheaths ; male inflorescence paniculate-cymose, laxly branched, usually 5–10 cm. long, up to 1·5 dm. ; spikelets numerous, spreading or cernuous, ovate to oblong, many-flowered, 1–2 cm. long ; bracts loosely imbricate, lanceolate to oblong-lanceolate, acute, mucronate, cartilaginous, with membranous margins, 4–9 mm. long ; perianth subsessile, oblong, cuneate at base, 3–4 mm. long ; segments membranous, or the outer lateral cartilaginous, the outer-lateral navicular, narrowly keeled, linear-oblong, acute to obtuse, apiculate, the anterior linear, acute ; inner segments linear-lanceolate, toothed or lacerate at the apex, slightly shorter to slightly longer than the outer ; female inflorescence spicate-cymose, mostly 5–10 cm. long, up to 2 dm. ; spathes on the main rhachis often conspicuous, erect-spreading, lanceolate, membranous, equalling to twice as long as the cymes they subtend ; spikelets numerous, erect, conical to oblong, many-flowered, 1·5–2·5 cm. long ; bracts loosely imbricate, oblong-lanceolate, mucronate, cartilaginous, membranous at the margins, 1–1·2 cm. long ; perianth stipitate, partly protruding beyond the sides of the bracts, orbicular, 4–6 mm. long ; outer segments linear, acute, cartilaginous, the lateral apiculate, with broad membranous wings ; wings decurrent on the stipe, clasping the bases of flowers above and overlapping the wings of adjacent flowers,

1·5–3 mm. broad ; inner segments linear-lanceolate, acute, membranous, distinctly shorter than the outer ; ovary compressed, ovate, surmounted by a solitary style.

South Africa : without precise locality, *Thunberg*, ♂ and ♀, *Masson*, ♀, *R. Brown*, ♀, *Sieber*, 230, ♂, 231, monstrosity, *Verreaux*, ♀, *Forbes in Hort. Soc.*, 89, ♂, *Thom*, 916, ♂ and ♀.

Cape Province—Cape Div. : flats near Rondebosch, *Burchell*, 180, ♂, *Pillans*, 4177, ♀ ; sandy flats at Wynberg, *Drège*, 130, ♂ ; Cape Flats, *Alexander*, ♀, *Marloth*, 3138, ♂ and ♀, 3138*b*, ♂ and ♀ ; north slopes of Table Mt., *Pappe in Herb. Mus. Austr.-Afr.*, 13004, ♀ ; base of Devil's Peak, *Bolus*, 4722, ♀ ; Wynberg, *Wallich*, ♂ ; lower north slopes of Wynberg Hill, *Pillans*, 4182, ♂ and ♀ ; mountains at Constantia, *Zeyher*, ♂ ; plateau on Red Hill, *Pillans*, 4178, ♂ and ♀.—Paarl Div. : French Hoek, *Phillips*, 1363, ♂.—Ceres Div. : Vaal Kloof, *Marloth*, 9107, ♂, 9108, ♀ ; Karroo Poort, *Marloth*, 9054, ♂ and ♀.—Worcester Div. : Du Toit's Kloof, *Tyson in Herb. Mus. Austr.-Afr.*, 6090, ♀ ; Touws River, *Marloth*, 3155, ♀.—Caledon Div. : Houwhoek, *Burchell*, 8131, ♀ ; between Villiersdorp and French Hoek, *Bolus*, 7502, ♀.—Bredasdorp Div. ; Koude River, *Schlechter*, 9738, ♀.—Riversdale Div. : Garcia's Pass, *Phillips*, 382, ♀.—Laingsburg Div. : Tweedside, *Marloth*, 10841, ♂ ; Witte Bergen, near Matjesfontein, *Marloth*, 3149, ♂ and ♀.—Prince Albert Div. : Seven Weeks Poort, *Phillips*, 1532, ♂ and ♀ ; Zwarte Bergen, *Marloth*, 3171, ♂.—Uitenhage Div. : Van Staden's Mt., *Ecklon in Herb. Mus. Austr.-Afr.*, 13005, ♂ and ♀.

This is the *Restio eriophorus*, Reichenbach, MSS. in Herb. Sieber !.

2. T. argenteus, *Kunth, Enum.*, iii, 432 (1841) !, excl. syn. omn. ; *Drège, Zwei Pfl. Documente*, 64, 118 (1844) ; *Steud., Synops. Pl.*, ii, 259 (1855), excl. syn. ; *Mast. in Journ. Linn. Soc.*, x, 227 (1868), excl. syn. ; *in DC. Monog. Phan.*, i, 317 (1878), excl. syn. ; *Durand et Schinz, Consp. Fl. Afr.*, v, 518 (1895), excl. syn. ; *Mast. in Fl. Cap.*, vii, 123 (1897), excl. syn. *Restio argenteus, Thunb.* ; *Mast. in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900) : **R. scariosus,** *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 46 (1875) !.

Stems sporadic on creeping rhizomes or caespitose, erect, rigid, simple or with slender barren branchlets, velvety pubescent, 6–15 dm. high, 3–4 mm. in diameter at the middle ; barren stems numerous, bearing tufts of slender branchlets with foliaceous sheaths ; sheaths at first closely convolute, soon becoming loose and lacerate in the upper parts, oblong-lanceolate, aristate, coriaceous in the lower and chartaceous in the upper half, membranous at the margins, velvety pubescent externally, 4·5–6 cm. long ; male inflorescence paniculate-cymose, mostly secund and plume-like, 1·5–3·5 dm. long ; spikelets numerous, spreading or cernuous, oblong

to linear-oblong, many-flowered, 2–3·5 cm. long; bracts quinquefarius, loosely imbricate, lanceolate, acuminate, mucronulate, chartaceous, pale, 8–10 mm. long; perianth subsessile, oblong, 3·5–4 mm. long; outer segments linear-oblong, obtuse, cartilaginous, the lateral navicular, with very narrow keels; inner segments lanceolate, obtuse, membranous, distinctly shorter than to equal with the outer; female inflorescence paniculate-cymose, compact or interrupted, linear to linear-oblong, mostly 1·5–3 dm. long, up to 4 dm.; spikelets numerous, erect, oblong to linear-oblong, many-flowered, 2–4 cm. long; bracts closely imbricate, lanceolate, acuminate, mucronulate, chartaceous, red-brown, becoming pale, 1·4–1·7 cm. long; perianth shortly stipitate, sometimes partly protruding beyond the sides of the bracts, elliptical or rotundate, 3·5–5 mm. long; segments cartilaginous, equal, subequal or the inner distinctly the shorter; the outer lateral navicular, keeled, linear-oblong, obtuse, minutely apiculate; keels evenly tapered to both ends or wider in the lower part, shortly decurrent on the stipe, membranous, up to 1·25 mm. in width; the anterior segment linear-lanceolate, acute or obtuse; inner segments lanceolate, acute, membranous at the margins; ovary compressed, ovate, minutely tubercled on the upper part, surmounted by a solitary style.

South Africa: without precise locality, *Thunberg*, ♂, *Masson*, ♀, *Bowie*, ♂.

Cape Province—Caledon Div.: Appels Kraal, *Ecklon and Zeyher*, 4349 partly, ♂ and ♀; Genadendal, *Drège*, 1611*a*, ♀.—Swellendam Div.: Tradouw Pass, *Marloth*, 8610, ♀.—Riversdale Div.: Garcia's Pass, *Burchell*, 6978, ♂ and ♀, *Bolus*, 11399, ♂, 11400, ♀; Corenti River Farm, *Muir in Herb. Galpin*, 5405, ♀.—Mossel Bay Div.: Mossel Bay, *Rogers*, 4225, ♂.—George Div.: Cradock Berg, *Galpin*, 4812, ♂ and ♀; George, *Rogers*, 4114, ♀, 4367, ♂.—Prince Albert Div.: Groote Zwarte Bergen, near Klaarstroom, *Drège*, 132, ♂, 132*b*, ♂; Zwartberg Pass, *Bolus*, 11664, ♂, *Tugwell in Bolus Herb.*, 14289, ♂ and ♀.—Uniondale Div.: Prince Alfred's Pass, *Schönland*, 3405, ♂.—Knysna Div.: Outeniqua Mts., *Rehmann*, 67, ♀.—Humansdorp Div.: Kromme River, *Drège*, 1611*b*, ♂; flats at Witte Els Bosch, *Fourcade*, 1016, ♀; Assegai Bosch, *Rogers*, 2804, ♂, 2805, ♂ and ♀; between Hofman's Bosch and Kareedouw, *Britten*, 1099, ♀.—Uitenhage Div.: Van Staden's, *Ecklon*, 291, ♀, *Drège*, 132*c*, ♂, *Bolus*, 1509, ♂, *F. Paterson*, 897, ♂ and ♀, *T. V. Paterson*, 2091, ♂, 2479, ♀.—Willowmore Div.: Aasvogel Berg, *Andreae*, 959, ♂ and ♀.—Port Elizabeth Div.: *E. S. C. A.*, *Herb.* 479, ♂.

3. T. glaber, *Pillans*, comb. nov.: **T. fruticosus,** *Berg.* var. *glaber*, *Mast. in Journ. Linn. Soc.*, x, 229 (1868)!; *in DC. Monog. Phan.*, i, 317 (1878); *in Fl. Cap.*, vii, 122 (1897).

Stems sporadic on creeping rhizomes or caespitose, erect, simple or with

slender barren branchlets, glabrous, puncticulate, 4–12 dm. high, 1–3·5 mm. in diameter at the middle; barren stems numerous, much branched, having many foliaceous sheaths with their membranous margins split into silk-like laciniae; sheaths on the fertile stems closely convolute, except where branchlets arise, oblong-lanceolate, acute, mucronate, membranous at the margins which soon become lacerate, striate, glabrous, red-brown, yellow-speckled, mostly 3·5–5 cm. long; male inflorescence loosely paniculate-cymose, 0·5–4 dm. long; spikelets spreading or cernuous, numerous, oblong to oblong-ovate, many-flowered, 1–1·5 cm. long; bracts loosely imbricate, lanceolate, mucronate, chartaceous, 7–10 mm. long; perianth subsessile, ovate-oblong, 3·5–5 mm. long; outer segments linear-oblong, obtuse, apiculate, cartilaginous; the lateral navicular, slightly keeled; inner segments linear-oblong, obtuse, hyaline-membranous, equalling or slightly exceeding the outer; female inflorescence spicate-cymose, interrupted, 8–25 cm. long; spikelets few to many, solitary or several at each node of the main rhachis, oblong, tapered at base, many-flowered, 2–5 cm. long; bracts loosely imbricate, lanceolate, acute or the lowermost acuminate, mucronate, cartilaginous or chartaceous, 1·5–2·5 cm. long; perianth hidden by its subtending bract, on a short and stout stipe, oblong, 4–6 mm. long; segments cartilaginous, equal or the inner slightly shorter than the outer; the outer linear-oblong; the lateral navicular, carinate, acute, apiculate or muticous; keels decurrent on the stipe, evenly tapered at both ends, up to 0·75 mm. in diameter; anterior segment obtuse, with a prominent midrib; inner segments deltoid-lanceolate, obtuse; ovary oblong-ovate, minutely tubercled, surmounted by a solitary style.

South Africa: without precise locality, *Bowie*, ♂.

Cape Province—KNYSNA DIV.: Melville, *Burchell*, 5462, ♂, 5548, ♂ and ♀; Concordia, *Galpin*, 4813, ♂ and ♀; Knysna Heads, *Schönland*, 3537, ♀; Belvidere, *Duthie*, 808, ♂.—HUMANSDORP DIV.: Rondebosch, *Schönland*, 3017, ♀.—UITENHAGE DIV.: Van Staden's River, *Drège*, 128 partly, ♀; Brookhuizen's Poort, *MacOwan*, 633, ♀; Bethelsdorp, *T. V. Paterson*, 1139, ♂.—PORT ELIZABETH DIV.: along the Baakens River, *Burchell*, 4363, ♀; Earn Cliff, *Galpin*, 6390, ♀, 6391, ♂, 6393, ♀; Walmer, *T. V. Paterson*, 2265, ♂; Port Elizabeth, *R. and T. Fries*, 3094.—KENTANI DIV.: near the coast, east of Kentani, *Pegler*, 791, ♂ and ♀.

4. T. Levynsiae, *Pillans*, sp. nov.; culmis rigidis teretibus laevibus albido-maculatis in partibus superioribus ramosis; ramis solitariis simplicibus, fertilibus; vaginis arcte convolutis lanceolato-oblongis acutis vel acuminatis mucronatis coriaceis nervoso-striatis ad margines late membranaceis; spiculis masculis erectis obovatis in paniculatas cymas dispositis; bracteis laxe imbricatis lanceolato-oblongis acutis mucronatis cartilagineis ferrugineis; perianthio breviter stipitato elliptico; segmentis

membranaceis; exterioribus lineari-oblongis acutis; lateralibus navicularibus carinatis; segmentis interioribus lanceolatis obtusis vel subacutis; spiculis femineis erectis oblongis vel obovatis in laxe paniculatas cymas vel spicatas dispositis; spathis vaginiformibus; bracteis erecto-patentibus lanceolato-oblongis acutis mucronatis cartilagineis ferrugineis; perianthio breviter stipitato elliptico apice late obtuso; segmentis cartilagineis acutis; exterioribus lateralibus lineari-oblongis navicularibus carinatis; segmentis interioribus oblongis externis aequalibus vel breviter superantibus; ovario obovato laevi; stylo dense lanato.

Stems arising from creeping rhizomes, erect, branched from below the middle upwards, rather stout and rigid, terete, smooth or drying sulcate, white speckled, 8–10 dm. high, about 3 mm. in diameter at the middle; branches solitary, erect, simple, compressed in their lower parts, some of the upper flowering during the first season, mostly flowering during the second season; sheaths closely convolute, lanceolate-oblong, acute or acuminate, mucronate, coriaceous, broadly membranous at the margins, nervose-striate, red-brown, 2–3 cm. long on the middle parts of the stems; male inflorescence laxly paniculate-cymose, 4–8 cm. long; spathes inconspicuous, sheath-like; spikelets many, erect, obovate, 6–8 mm. long; spathellae oblong-lanceolate, acute, subulate-mucronate, cartilaginous, broadly membranous at the margins, 5–7 mm. long; bracts loosely imbricate, lanceolate-oblong, acute, mucronate, cartilaginous, ferruginous, 4–5 mm. long; perianth shortly stipitate, elliptic, 2·25–2·75 mm. long; segments membranous; the outer lateral navicular, linear-oblong, acute carinate; the anterior linear-oblong, subacute; inner segments lanceolate, subacute or obtuse; female inflorescence laxly paniculate- or less often spicate-cymose, oblong or linear-oblong, 4–8 cm. long; spathes sheath-like, 1·5–2·5 cm. long; spikelets erect, oblong or obovate, 1–1·5 cm. long; spathellae lanceolate, acute, mucronate, cartilaginous, broadly membranous at the margins, slightly longer than the subtended spikelet; bracts erect-spreading, lanceolate-oblong, acute, mucronate, cartilaginous, ferruginous, 8–12 mm. long; perianth almost entirely hidden by its subtending bract, shortly stipitate, elliptic, rather broader above than below the middle; broadly rounded at the apex, 3·5–4·5 mm. long; segments cartilaginous, acute; the outer lateral linear-oblong, navicular, with a narrow keel which is broadest above the middle; the anterior linear-oblong; inner segments oblong, equalling or shortly exceeding the outer; ovary obovate, smooth; style with unusually long, white stigmatic hairs.

South Africa: Cape Province—Cape Div.: south-east slopes of Kalk Bay Mt., *M. R. Levyns*, 1404, ♂ and ♀ (type), *in Bolus Herb*, 18440, ♂.

5. T. nutans, *Pillans*, comb. nov.: **Restio nutans,** *Thunb. in Hoffm. Phytog. Blätter*, i, 7 (1803)!; *in Weber et Mohr, Archiv*, i, 25 (1804); *Pers.*,

Syn. Pl., ii, 606 (1807) ; *Thunb., Fl. Cap.*, ed. i, p. 321 (1811) ; ed. *Schultes*, 84 (1823) ; *Kunth, Enum.*, iii, 413 (1841) ; *Steud., Synops. Pl.*, ii, 254 (1855) ; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 416 (1875) : **Thamnochortus consanguineus,** *Kunth, op. cit.*, 432 ! ; *Steud., op. cit.*, 259 : **T. elongatus,** *Mast. in Journ. Linn. Soc.*, x, 226 (1868) !, pro mult. parte excl. syn. mult. ; *Mast., op. cit.*, xiv, 416 ; *in DC. Monog. Phan.*, i, 320 (1878), excl. syn. mult. ; *in Fl. Cap.*, vii, 123 (1897), excl. syn. mult.

Stems caespitose, erect, simple, rigid and wiry, terete, smooth, minutely white-speckled, 4–6 dm. high, 2 mm. in diameter at the middle ; sheaths tightly convolute, oblong, acute, mucronate, coriaceous, striate, cartilaginous and soon lacerate at the upper margins, mostly 4–4·5 cm. long ; male inflorescence a plume-like panicle, 1–1·5 dm. long ; spikelets many, at first erect, becoming cernuous, oblong, tapered in the lower part, red-brown, 1·2–1·8 cm. long ; spathes and spathellae sheath-like, the latter about half as long as the spikelets ; bracts loosely convolute, oblong-lanceolate, acuminate, mucronate, cartilaginous, 8–10 mm. long ; perianth shortly stipitate, oblong-obovate, reddish, 4 mm. long ; segments linear-oblong, acute, membranous, subequal ; the outer lateral navicular, keeled ; female inflorescence spicate or paniculate, 5–10 cm. long ; spikelets few to many, erect, adjacent, oblong, tapered in the lower part, 1·5–2 cm. long ; spathes and spathellae sheath-like, the latter equalling or slightly shorter than the spikelets ; bracts as in the male but 1–1·2 cm. long ; perianth stipitate, rotundate, compressed, widest at the middle, thence tapered to the base, 3·5–3·75 mm. long ; segments linear-oblong, obtuse, cartilaginous, equal or subequal ; the outer lateral navicular, with narrow wings ; ovary obliquely obovate, surmounted by a solitary style.

South Africa : without precise locality, *Masson in Herb. Thunberg*, ♂, *Garnot*, ♂, *Sieber* 223, ♂, *E. Fries*, ♂.

Cape Province—Cape Div. : summit of Table Mt., *Burchell*, 525, ♂, *Bolus*, 2883, ♂ and ♀, *Rehmann*, 625, ♂, *L. Kensit in Bolus Herb.*, 9698, ♂, 9699, ♀, *Marloth*, 3122, ♀, *Pillans*, 4351, ♂ and ♀, 4376, ♂ and ♀.

6. T. Muirii, *Pillans*, sp. nov. ; culmis caespitosis ; sterilibus ramossimis foliosis ; fertilibus simplicibus teretibus albido-maculosis ; vaginis arcte convolutis oblongo-lanceolatis acutis mucronulatis, coriaceis ; spiculis masculis ovato-lanceolatis vel oblongis in cymam paniculiformem dispositis ; bracteis laxe imbricatis oblongo-lanceolatis ; perianthio sessili oblongo ; segmentis exterioribus lateralibus carinatis ; spiculis femineis ovato-lanceolatis vel oblongis in spicatum cymam dispositis ; bracteis ovato-lanceolatis vel oblongo-lanceolatis acutis vel acuminatis coriaceis ; perianthio breviter stipitato oblongo ; segmentis exterioribus lateralibus anguste alato-carinatis ; segmentis interioribus lanceolatis externis brevioribus ; ovario turbinato ; stylo solitario.

Stems caespitose, erect, simple, terete, smooth, minutely white-speckled, 8–12 dm. high, 1·5–1·75 mm. in diameter at the middle, sometimes accompanied by slender, branched, barren stems; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, thinner at the margins, 3–4 cm. long; male inflorescence laxly paniculate-cymose, 6–15 cm. long; spathes inconspicuous, cartilaginous; spikelets erect, spreading or cernuous, ovate-lanceolate to oblong, 8–10 mm. long; bracts loosely imbricate, oblong-lanceolate, subacute, muticous, cartilaginous, membranous at the margins, 4–5 mm. long; perianth sessile, oblong, 3 mm. long; outer lateral segments navicular, carinate, linear-oblong, obtuse, membranous, with a cartilaginous midrib; the anterior linear-lanceolate, acute, hyaline; inner segments oblong-lanceolate, acute, hyaline-membranous, shortly exceeding the outer; female inflorescence spiciform, 5–8 cm. long; spathes erect, oblong-lanceolate, acuminate, mucronate, coriaceous, becoming lacerate at the apex and margins, chestnut-brown, 2–2·5 cm. long; spikelets adjacent, usually 2–4, ovate-lanceolate to oblong, tapered at the base, 1·5–2·5 cm. long; bracts loosely convolute, ovate-lanceolate to oblong-lanceolate, acuminate, mucronulate, cartilaginous to coriaceous, membranous at the margins, 6–10 mm. long; perianth shortly stipitate, oblong, 4–4·5 mm. long; outer lateral segments navicular, narrowly wing-carinate, linear-oblong, obtuse, cartilaginous; keels entire, firm and opaque, except at the base of the segment, broadest at the middle, narrowed at base and apex, 0·75–1 mm. in diameter, soft and hyaline at base, decurrent on the stipe; anterior segment linear-lanceolate, acute, cartilaginous; inner segments lanceolate, acute, cartilaginous, shorter than the outer; ovary turbinate, flat on its summit, surmounted by a solitary style.

South Africa: Cape Province—Riversdale Div.: Botteliersfontein, *Muir*, 1444, ♂ and ♀ (type); near the coast, *Hortense Muir in Bolus Herb.*, 17828, ♂.—Mossel Bay Div.: hills near the landing place at Mossel Bay, *Burchell*, 6284, ♂ and ♀; Robinson's Pass, *Rogers*, 4268, ♀.

7. T. scabridus, *Pillans*, sp. nov.; culmis erectis simplicibus gracilis teretibus scabridis; vaginis arcte convolutis ad apicem interdum laxis lineari-oblongis acutis vel paulo acuminatis mucronatis ad basem cartilagineis superne membranaceis; spiculis masculis patentibus vel cernuis obovatis vel oblongis in laxe paniculatas cymas dispositis; bracteis laxe imbricatis ovato-lanceolatis acutis mucronulatis cartilagineis ferrugineis; perianthio subsessili elliptico; segmentis membranaceis ferrugineis; exterioribus lateralibus oblanceolatis acutis navicularibus; segmentis interioribus oblongo-lanceolatis obtusis externis longioribus; spiculis femineis solitariis vel geminatis obovatis ad basem cuneatis; spatha vaginiformi acuminata membranacea spicula longiore; bracteis erecto-patentibus; inferioribus spathiformibus; superioribus oblongis acuminatis

mucronulatis cartilagineis ad margines pallido-membranaceis; perianthio stipitato elliptico; segmentis exterioribus lateralibus lineari-oblongis acutis navicularibus decurrentibus cartilagineis membranaceo-carinatis segmentis aliis distincte longioribus; segmento anteriore lanceolato acuto; segmentis interioribus oblongo-lanceolatis acutis membranaceis; ovario obovato distincte scabrido; stylo gracili.

Stems caespitose, erect, simple, slender, terete, rough with small tubercles, about 5 dm. high, about 1 mm. in diameter at the middle; sheaths closely convolute, occasionally loose at the apex, linear-oblong, acute or somewhat acuminate, mucronate, cartilaginous at base, membranous upwards, light brown, mostly 4·5–8 cm. long; male inflorescence laxly paniculate-cymose, usually 4–8 cm. long; spathes erect, sheath-like, membranous; spikelets on spreading, declinate or, less often, erect, filiform rhachillae, obovate or oblong, 5–8 mm. long; bracts loosely imbricate, ovate-lanceolate, acute, mucronulate, cartilaginous, ferruginous, 4–5 mm. long; perianth subsessile, elliptic, about 3 mm. long; segments membranous, ferruginous; the outer lateral oblanceolate, navicular, acute; the anterior segment not seen; inner segments oblong-lanceolate, obtuse, distinctly exceeding the outer; female spikelets solitary or in pairs, obovate, cuneate at base, 1·5–2 cm. long; spathe sheath-like, acuminate, membranous, overtopping the spikelet; bracts erect-spreading, the lower resembling the spathe and nearly as long, those above being oblong, acuminate, mucronulate, cartilaginous, light brown, broadly pale-membranous at the margins, about 1 cm. long; perianth on a stout, scabrid stipe, elliptic, 5–5·5 mm. long; outer lateral segments linear-oblong, acute, navicular, long-decurrent on the stipe, cartilaginous, longer than the other segments, with a pallid, membranous keel 0·5–1 mm. in diameter; anterior segment lanceolate, acute, cartilaginous; inner segments oblong-lanceolate, acute, membranous, much shorter than the outer; ovary obovate, compressed, with two vertical ridges at one of the angles, conspicuously scabrid; style slender.

South Africa: Cape Province—Worcester Div.: sandstone hill between Eendragt and Triangle, *Levyns*, 395, ♂, 369, ♀ (type); flats near Bokke River, between Touws River and Ceres, *Levyns*, 922, ♂.

8. T. ellipticus, *Pillans*, sp. nov.; culmis erectis gracilibus teretibus laevibus simplicibus vel ramis sterilibus; vaginis arcte convolutis lineari-oblongis acuminatis aristatis cartilagineis nervoso-striatis purpureis ad margines pallido-membranaceis; spiculis femineis 1–3, oblongis vel late cuneatis in spicatas cymas dispositis; spathis vaginiformibus spiculis longioribus; bracteis erecto-patentibus oblongo-lanceolatis setaceo-acuminatis cartilagineis purpureis; perianthio stipitato elliptico vel cuneato-elliptico; segmentis exterioribus lateralibus lineari-oblongis acutis navicularibus carinatis cartilagineis; segmento antico lineari-lanceolatis

acutis ; segmentis interioribus lanceolatis obtusis membranaceis externis brevioribus ; ovario turbinato laevi ; stylo gracili.

Stems caespitose, erect, simple or in their second season bearing 1 or 2 slender, divided branches at all or most of the nodes, terete, slender, smooth, 3–5 dm. high ; sheaths closely convolute, linear-oblong, acuminate, slender-aristate, cartilaginous, pale-membranous at the margins, nervose-striate, purplish, yellow-speckled, mostly 3·5–4·5 cm. long ; female spikelets 1–3, in spicate cymes, oblong or broadly cuneate, cuneate at base, 1·5–2 cm. long ; spathe sheath-like, expanded in its upper parts, much overtopping the accompanying spikelet ; bracts erect-spreading, oblong-lanceolate, setaceo-acuminate, thinly cartilaginous, having 1–3 raised nerves, purplish, 1–1·5 cm. long ; perianth usually entirely hidden by the bract, stipitate, elliptic or cuneate-elliptic, 4 mm. long ; outer lateral segments linear-oblong, acute, navicular, cartilaginous, with a keel that is not broadest at any part and is slightly broader than the body of the segment ; anterior segment linear-lanceolate, acute ; inner segments lanceolate, obtuse and often shortly toothed at the apex, membranous, much shorter than the outer ; ovary turbinate, smooth ; style central, slender.

South Africa : Cape Province—Riversdale Div. : Phisantefontein, north slopes of the Langebergen, *Muir*, 3187, ♀ (type).

9. T. paniculatus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 12 (1900) !.

Stems caespitose, erect, simple, rigid, terete, smooth, minutely white-speckled, red and shortly hirsute on the basal internodes, 5–10 dm. high, 1·75–2·5 mm. in diameter at the middle ; sheaths tightly convolute, oblong, acute, mucronate, coriaceous, narrowly membranous at the upper margins, striate, minutely white-speckled, 2·5–3·5 cm. long ; male inflorescence a lax panicle, 4–8 cm. long ; spathes conspicuous, lanceolate, acuminate, about 3 cm. long ; spikelets erect or cernuous, oblong-ovate, many-flowered, 6–10 mm. long ; bracts loosely imbricate, ovate-lanceolate, acute, often mucronulate and keeled on the upper half, cartilaginous, ferruginous, 4–5 mm. long ; perianth partly protruding beyond its bract, ovate-oblong, 2·5–3 mm. long ; outer segments linear, acute cartilaginous ; the lateral navicular, narrowly keeled ; inner segments oblong-lanceolate, acute, membranous, subequalling the outer ; female inflorescence spicate- or paniculate-cymose, 6–10 cm. long ; spathes sheath-like, half as long as to equal with the spikelets ; spikelets usually 3–6, oblong, many-flowered, 2–2·5 cm. long ; bracts loosely imbricate, often expanded, lanceolate, acute, mucronulate, chartaceous, red-brown, 1–1·4 cm. long ; perianth hidden, stipitate, oblong, 4·5–6 mm. long ; outer segments decurrent at base upon the stipe, coriaceous ; the lateral navicular, linear-oblong, obtuse, apiculate, nearly equal in depth at middle and apex, with a hard, entire keel ; anterior

segment linear-oblong, subacute, much shorter than the lateral; inner segments oblong-lanceolate, acute to obtuse, cartilaginous, half as long as the outer-lateral; ovary cuneate-oblong, surmounted by a solitary style.

South Africa: Cape Province—Bredasdorp Div.: Mierkraal, *Schlechter*, 10511, ♂, 10512, ♀.—Riversdale Div.: the Downs, *Muir*, 3108, ♂ and ♀.

10. T. fraternus, *Pillans*, sp. nov.; culmis simplicibus teretibus laevibus; vaginis arcte convolutis lanceolato-oblongis acutis mucronatis coriaceis nervoso-striatis; spiculis masculis cernuis ovato-oblongis vel oblongis in paniculatas cymas dispositis; bracteis erecto-patentibus lanceolatis acutis muticis vel mucronulatis cartilagineis ferrugineis; perianthio breviter stipitato elliptico; segmentis exterioribus lineari-oblongis acutis membranaceis; segmentis interioribus lanceolatis acutis vel obtusis externis breviter longioribus; spiculis femineis erectis oblongis; bracteis erecto-patentibus oblongis lanceolatis acutis mucronatis cartilagineis ferrugineis; perianthio stipitato elliptico; segmentis exterioribus lineari-oblongis acutis ad basem decurrentibus; lateralibus carinatis; segmentis interioribus ovatis acutis externis breviter brevioribus; ovario subelliptico compresso scabrido; stylo gracili.

Stems caespitose, erect, simple, rigid, terete, smooth, usually becoming unevenly sulcate when drying, minutely white-speckled, about 1 m. high; sheaths tightly convolute, lanceolate, oblong, acute, mucronate, coriaceous, narrowly membranous at the margins, nervose-striate, at first green, becoming brown, mostly 2·5–3·5 cm. long; male inflorescence laxly paniculate-cymose, usually 6–12 cm. long; spathes sheath-like but smaller; rhachillae in groups of 3–5, declinate or a few erect-spreading, slender, much compressed, the unbranched portions of the lower ones 1·5–2 cm. long; spikelets cernuous, oblong or ovate-oblong, cuneate at base, rounded or acute at apex, 1–1·5 cm. long; spathellae lanceolate, acute, cartilaginous, brown, 5–10 mm. long; bracts erect-spreading, lanceolate, acute, muticous or mucronulate, cartilaginous, ferruginous, 3·5–5 mm. long; perianth shortly stipitate, elliptic or cuneate-elliptic, 2·5–3 mm. long; outer segments linear-oblong, acute, membranous, reddish; the lateral much compressed laterally, dorsally keeled; inner segments lanceolate, acute or obtuse, membranous, reddish, pale at the apex, shortly exceeding the outer; female inflorescence narrowly paniculate- or, less often, spicate-cymose, lax, 1–2 dm. long; spathes sheath-like; spikelets numerous, erect, oblong, cuneate at base, 1·5–2·5 cm. long; bracts erect-spreading, oblong-lanceolate, acute, mucronate, cartilaginous, ferruginous, 1·2–1·4 cm. long; perianth quite hidden by its subtending bract, on a stout, cuneate stipe, elliptic, 3·5–4 mm. long; outer segments linear-oblong, acute, cartilaginous, red-brown, decurrent on the stipe where 3 perpendicular channels are formed between the separated margins; the lateral navicular, with a keel 0·5 mm.

in depth ; inner segments ovate, acute, cartilaginous, slightly shorter than the outer ; ovary obliquely elliptic, scabridous, red-brown ; style solitary, slender.

South Africa : Cape Province—Stellenbosch Div. : sandy flats between De Beers and the mouth of the Eerste River, *Pillans*, 4904, ♂ and ♀.

11. T. pluristachyus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 12 (1900) !.

Stems caespitose, erect, simple, rigid, smooth, minutely yellow-speckled, 6–9 dm. high, 2–2·5 mm. in diameter at the middle ; sheaths tightly convolute, lanceolate-oblong, acute to acuminate, mucronate, coriaceous, membranous at the margins, finely striate, about 3 cm. long ; male inflorescence laxly paniculate-cymose, 1–1·5 dm. long ; spikelets numerous, on slender rhachillae, narrow-oblong, many-flowered, 6–10 mm. long ; spathe at the base of each spikelet oblong-lanceolate, acute, mucronate, membranous, half as long as to equal with the spikelet ; bracts closely convolute, ovate-lanceolate, acute, coriaceous, membranous and soon lacerate at the upper margins, 4 mm. long ; perianth sessile, ovate, 2·25–2·5 mm. long ; outer segments linear-oblong, obtuse, cartilaginous ; the lateral navicular, slightly keeled ; inner segments oblong-ovate, obtuse, membranous, equalling the outer ; female inflorescence paniculate-cymose, 5–8 cm. long ; spathes lanceolate, acute, mucronate, membranous, exceeding the spikelets ; spikelets numerous, sessile or on short branchlets, oblong, tending to oblanceolate, many-flowered, 1·5–1·8 cm. long, 3–3·5 mm. in diameter ; bracts closely imbricate, oblong-lanceolate, mucronulate, coriaceous, membranous and soon lacerate at the upper margins, 7–8 mm. long ; perianth hidden, subsessile, rotundate, 2·5 mm. long ; outer segments linear-oblong, acute, cartilaginous ; the lateral navicular, deeply keeled ; inner segments ovate, obtuse, membranous, shorter than the outer ; ovary orbicular, surmounted by a solitary style.

South Africa : Cape Province—Bredasdorp Div. : hills near Mierkraal, *Schlechter*, 10524, ♂, 10525, ♀.

12. T. Guthrieae, *Pillans*, sp. nov. ; culmis simplicibus vel parum ramosis papillosis ; vaginis arcte convolutis oblongo-lanceolatis acutis vel acuminatis mucronatis cartilagineis ferrugineis ad margines pallido-membranaceis ; spiculis masculis erecto-patentibus vel deflexis oblongis in cymas paniculatas dispositis ; bracteis erecto-patentibus oblongo-lanceolatis cartilagineis ; perianthio sessili ovato-oblongo ; segmentis exterioribus lineari-lanceolatis cartilagineis ; segmentis interioribus oblongis obtusis hyalino-membranaceis ; spiculis femineis erectis oblongis in cymas paniculatas dispositis ; bracteis lineari-lanceolatis acutis cartilagineis ; perianthio stipitato elliptico ; segmentis exterioribus lineari-lanceolatis acutis cartilagineis; segmentis lateralibus carinatis; interioribus brevioribus lineari-oblongis

obtusis, hyalino-membranaceis; ovario ovato apud apicem papilloso; stylo solitario.

Stems caespitose, erect, simple or bearing a few barren branchlets, slender, papillose, pale green, 3–5 dm. high, about 1 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acute or acuminate, mucronate, cartilaginous, with deciduous, white-membranous margins, soon lacerate at the apex, striate, ferruginous, 3–4·5 cm. long; male inflorescence loosely paniculate-cymose, 4–5 cm. long; spikelets many, erect-spreading or cernuous, cylindric-oblong, 1·5–2 cm. long; bracts erect-spreading, oblong-lanceolate, acute, mucronulate, cartilaginous, pale-membranous at the margins, about 8 mm. long; perianth sessile, ovate-oblong, 3·5 mm. long; outer lateral segments linear-lanceolate, obtuse, apiculate, cartilaginous; the anterior linear, acute; inner segments oblong, obtuse, hyaline-membranous, subequal with the outer; female inflorescence linear paniculate-cymose, lax, 6–10 cm. long; spikelets erect, cylindric-oblong, many-flowered, 1·5–2 cm. long; bracts loosely convolute, linear-lanceolate, acute, mucronulate, cartilaginous, about 1·2 cm. long; perianth on a short, stout stipe, elliptic, 4–5 mm. long; outer segments linear-lanceolate, acute, cartilaginous; the lateral carinate; keels 0·5–0·75 mm. in diameter; inner segments linear-oblong, obtuse, hyaline-membranous, distinctly shorter than the outer; ovary ovate, papillose at the apex, surmounted by a solitary style.

South Africa: Cape Province—Caledon Div.; south slopes of the Zwartberg, at Caledon, *L. Guthrie in Bolus Herb.*, 17215, ♂ and ♀.

13. T. Schlechteri, *Pillans*, nom. nov.: **T. Bachmannii,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 13 (1900)!, non *Ann. K.K. Natur. Hofmus.*, xv, No. 1, p. 11 (1900).

Stems caespitose, erect, simple, wiry, smooth, very minutely yellow-spotted, 2–3 dm. high, 1 mm. in diameter at the middle; sheaths closely convolute, soon becoming loose and lacerate at the margins, linear-lanceolate, acute, mucronulate, cartilaginous in the lower half, hyaline-membranous in the upper half and at the margins, closely striate, mostly 3·5–4·5 cm. long; male inflorescence laxly paniculate-cymose, 2–2·5 cm. long; spikelets 2–4, spreading or cernuous, on filiform rhachillae, ovate to cuneate-oblong, many-flowered, 4–6 mm. long; bracts loosely imbricate, lanceolate, acuminate, mucronulate, subcoriaceous, reddish, narrowly white-membranous at the margins, 6–7 mm. long; perianth stipitate, cuneate-oblong, 3 mm. long; outer segments linear-oblong, membranous; the lateral obtuse, apiculate, scarcely keeled; the anterior acute, shorter; inner segments oblong-lanceolate, obtuse, slightly exceeding the outer; female spikelets solitary or rarely in pairs, cuneate-oblong, many-flowered, 1·5–2·5 cm. long; spathes 1 or 2, lanceolate, acuminate, chartaceous, ferruginous,

exceeding the spikelet; bracts loosely imbricate, lanceolate, acuminate, mucronulate, chartaceous, 0·5–1·5 cm. long; perianth on a short, stout stipe, 4·5–5 mm. long; outer lateral segments navicular, linear-oblong, obtuse, apiculate, deeply keeled, cartilaginous, distinctly exceeding all the others; keels 0·75 mm. in diameter; anterior segment lanceolate, subacute, equalling the inner; inner segments deltoid-lanceolate, obtuse, membranous; ovary orbicular, scabrid, surmounted by a solitary style.

South Africa: Cape Province—Ceres Div.: Cold Bokkeveld, Tafelberg, *Schlechter*, 10088, ♂, 10089, ♀.

Masters published his *T. Bachmannii* in the *Annalen des K.K. Natur. Hofmus.*, vol. xv, part 1, during the first half of the year 1900. In this place he quotes Penther, 386 and 398, and Bachmann, 1773. In December 1900, Masters publishes a *T. Bachmannii* as a new species in *Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 13. Here he quotes the above-mentioned Penther and Bachmann plants along with Wolley-Dod, 2446, and Schlechter, 10088 and 10089. But the second description applies only to Schlechter's plants, which belong to a species distinct from the first *T. Bachmannii*.

14. T. dumosus, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 11 (1900)!: **T. canescens,** *Mast., op cit.*, p. 12!.

Stems caespitose, erect, simple or with a few tufts of barren branchlets, slender, smooth, obscurely yellow-spotted, 2–4 dm. high, 0·5–1 mm. in diameter at the middle; barren stems often many, much branched, slender, bearing sheaths with long-foliaceous mucros, much shorter than the flowering; sheaths on flowering stems distant, closely convolute, linear-oblong, acuminate, aristate, chartaceous in the lower parts, membranous and soon lacerate in the upper, about 2·5 cm. long; male inflorescence laxly paniculate-cymose, 3–5 cm. long; spikelets numerous, spreading or cernuous, narrow-cylindric, becoming oblong, narrowed at the base, many-flowered, 1–1·8 cm. long; bracts loosely imbricate, oblong-lanceolate, acuminate, mucronate to shortly aristate, cartilaginous, broadly membranous at the margins, pale, with a red median nerve, 5–8 mm. long; perianth shortly stipitate, cuneate-oblong, 2·5–4 mm. long; outer segments linear, acute, membranous; the lateral navicular, narrowly keeled, apiculate, cartilaginous at the midrib; the anterior flattened, much shorter; inner segments lanceolate, subacute to obtuse, subequal with the anterior; female inflorescence spicate-cymose, 2–4 cm. long; spikelets 2–4, adjacent, at first cylindric, becoming ovate or ovate-oblong, many-flowered, 1–1·5 cm. long; spathes sheath-like but shorter, mostly with the awn exceeding the spikelet; bracts as in the male; perianth stipitate, hidden or partly showing beyond the sides of the bracts, elliptic, becoming cuneate with fruit, at first compressed, becoming trigonous, 4–5·5 mm. long; outer segments lanceolate, acute, cartilaginous, broadly hyaline-membranous at the margins; the lateral navicular, apiculate, with

a narrow membranous keel; inner segments united at the base, lanceolate, acute, cartilaginous, membranous at their margins, becoming rigidly coriaceous and then showing 3–5 conspicuous nerves, mucronate to shortly aristate, distinctly exceeding the outer; ovary ovate to oblong, obscurely 3-angled, becoming trigonous, minutely tuberculate-rugose on its upper parts, surmounted by a solitary style.

South Africa: Cape Province—Caledon Div.: Houwhoek, *Schlechter*, 7786, ♀, 7787, ♂.—Bredasdorp Div.: Koude River, *Schlechter*, 10452, ♂, 10453, ♀.—Paarl Div.: French Hoek mountains, *Pickstone*, 10, ♂, 14, ♀, 15, ♀.

15. T. platypteris, *Kunth, Enum.*, iii, 429 (1841)!; *Drège, Zwei Pfl. Documente*, 70, 71 (1844); *Steud., Synops. Pl.*, ii, 258 (1855); *Mast. in Journ. Linn. Soc.*, x, 226 (1868); *in DC. Monog. Phan.*, i, 322 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 519 (1895); *Mast. in Fl. Cap.*, vii, 125 (1897).

Stems erect, simple, rather slender, puncticulate, about 6 dm. high, 1–1·5 mm. in diameter at the middle; sheaths distantly situated, closely convolute, oblong-lanceolate, acute, mucronate, cartilaginous, striate, about 4·5 cm. long; male spikelets numerous, in erect or cernuous panicles, ovate to oblong, 8–10 mm. long; bracts loosely imbricate, lanceolate, acute, mucronulate, cartilaginous, 5–6 mm. long; perianth subsessile, oblong, cuneate at base, about 4 mm. long; segments acute, membranous, the outer lateral navicular, carinate, linear-oblong; the anterior linear; inner segments oblong-lanceolate, distinctly exceeding the outer; female inflorescence spicate-cymose, oblong, 3–5 cm. long; spathes sheath-like, acuminate, chartaceous, mostly exceeding the spikelets; spikelets adjacent, ovate to oblong, cuneate at base, many-flowered, 1–1·5 cm. long; bracts loosely imbricate, lanceolate, acuminate, mucronulate, chartaceous, 8–12 mm. long; perianth stipitate, orbicular, 6 mm. long; outer lateral segments linear-lanceolate, acute, mucronulate, cartilaginous, broadly winged on the dorsal angle; wings conspicuously protruding beyond the sides of the bracts and embracing adjoining flowers, decurrent on the stipe, membranous, 2·5–3 mm. broad; anterior segment lanceolate, distinctly shorter than the lateral; inner segments lanceolate, acute, cartilaginous, equalling the anterior; ovary oblong, with lateral ridges, smooth, surmounted by a solitary style.

South Africa: Cape Province—Clanwilliam Div.: Pakhuis, *L. Diels*, 1213, ♂.—Van Rhyn's Dorp Div.: Gift Berg, *Drège*, 139 partly, ♀, 2502*b*, ♂; between Grasberg and Waterval, *Drège*, 2502*a*, ♂, 2512, ♀.—Calvinia Div.: Waterkloof, *L. Diels*, 614, ♂ and ♀, 1215, ♀, 1216, ♂ and ♀.

16. T. Bachmannii, *Mast. in Ann. K.K. Natur. Hofmus.*, xv, No. 1, p. 11 (1900)!: **T. sulcatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 11 (1900)!.

Stems erect, simple, slender, terete or somewhat compressed and sulcate, through contraction, when dry, rugulose, minutely white-spotted, 6–8 dm. high, 1·5 mm. in diameter at the middle ; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, striate, ferruginous, pale membranous at the margins, 3·5–6 cm. long ; male inflorescence laxly paniculate, 3–10 cm. long ; spikelets numerous, erect, spreading or cernuous, ovate to oblong, 5–12 mm. long ; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, cartilaginous, ferruginous, pale membranous at the margins, 3·5–4·5 mm. long ; perianth subsessile, ovate-oblong, 3–4 mm. long ; segments linear-oblong, obtuse or subacute, often emarginate or dentate at the apex, membranous ; the outer lateral navicular, carinate, apiculate ; the inner distinctly longer than the outer ; female inflorescence spiciform, 3–6 cm. long ; spathes sheath-like, chartaceous, pale, exceeding the spikelets ; spikelets numerous, adjacent, ovate to oblong, many-flowered, 1–1·5 cm. long ; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, cartilaginous, ferruginous, pale membranous at the margins, 6–8 mm. long ; segments cartilaginous, obtuse ; the outer linear-oblong ; the lateral navicular, with a crescent-shaped, entire wing ; inner segments lanceolate, distinctly shorter than the outer ; ovary ovate-oblong, scabrid with raised cells, surmounted by a solitary style.

South Africa : Cape Province—Malmesbury Div. : Hopefield, *Bachmann*, 1773, ♀, *Bolus*, 12897, ♂, 12898, ♀.—Clanwilliam Div. : Brakfontein, in Olifants River Valley, *Ecklon and Zeyher*, ♂ and ♀.—Little Namaqualand : dunes 6 miles east of Hondeklip Bay, *Pillans in Bolus Herb.*, 17934, ♂ and ♀.

17. T. Stokoei, *Pillans*, sp. nov. ; culmis simplicibus, gracilibus laevibus : vaginis lineari-oblongis acuminatis aristatis cartilagineis ; spiculis femineis ovatis vel oblongis 1 vel 2 in cymam spiciformem dispositis ; spathis vaginiformibus ; bracteis laxe imbricatis vel erecto-patentibus oblongo-lanceolatis acutis mucronulatis chartaceis ferruginosis ad margines late pallido-membranaceis ; perianthio sessili orbiculari vel rotundo ; segmentis exterioribus oblongo-lanceolatis subacutis cartilagineis ; lateralibus alatis ; segmentis interioribus lanceolatis subacutis vel obtusis exterioribus parum brevioribus ; ovario rotundo stylo unico superato.

Stems caespitose, erect, simple, slender, terete, smooth, 3–4 dm. high, about 1 mm. in diameter at middle ; sheaths 1 or 2 above the base of the stem, closely convolute in their lower parts, loosely so in their upper, linear-oblong, acuminate, slender-aristate, cartilaginous, brown, pale-membranous at apex and margins, soon becoming lacerate in their upper parts, mostly 5–6 cm. long ; female spikelets 1 or 2, in spicate cymes, adjacent, obovate or oblong, 1·5–2·3 cm. long ; spathes sheath-like, erect-spreading, chartaceous, becoming lacerate, shortly exceeding to twice as long as the

subtended spikelet; bracts loosely imbricate or erect-spreading, oblong-lanceolate, acute, mucronulate, chartaceous, ferruginous, broadly pale-membranous at the margins, 1–1·5 cm. long; perianth sessile, orbicular or occasionally subrotundate, 3–4 mm. long; outer segments oblong-lanceolate, subacute, cartilaginous, reddish; the lateral winged, 1·5–2 mm. in depth with the wing; the lower margins of the wings often reaching below the base of the perianth; inner segments lanceolate, subacute or obtuse, slightly shorter than the outer; ovary rotundate, compressed, with prominent, swollen angles; style solitary.

South Africa: Cape Province—Worcester Div.: Onklaarberg, 20 miles south of Worcester, *Stokoe*, 1214, ♀.

18. T. punctatus, *Pillans*, sp. nov.; culmis caespitosis erectus simplicibus vel prope basem ramosis impresso punctatus; inflorescentia mascula laxe paniculata cymosa; spiculis oblongis vel lineari-oblongis; bracteis lanceolatis mucronulatis ad margines membranaceis; perianthio elliptico; segmentis exterioribus lateralibus lineari-oblongis, carinatis; spiculis femineis oblanceolatis vel oblongis in cymam spiciformem vel paniculatam dispositis; bracteis lanceolatis mucronulatis ad margines pallido-membranaceis; perianthio stipitato orbiculari; segmentis pallido-membranaceis vel exterioribus lateralibus superioribus partibus fulvis; exterioribus lateralibus lineari-oblongis obtusis late alatis; interioribus ovatis obtusis; ovario orbiculari laevi stylo unico superato.

Stems caespitose, erect, simple or bearing a few barren branches on their lower parts, slender, rugulose, with sunken brown spots or brown furrows, minutely white-speckled, mostly 4–6 dm. high, 1·25–1·5 mm. in diameter at middle; sheaths closely convolute, oblong-lanceolate, acuminate, aristate, coriaceous at base, cartilaginous upwards, with broad, hyaline-membranous margins, soon becoming lacerate, chestnut-brown, mostly 2·5–3·5 cm. long without the awn; male spikelets numerous, in lax, panicled cymes, oblong or linear-oblong, cuneate at base, 1·2–2 cm. long; spathes sheath-like but smaller; spathellae bract-like; bracts loosely imbricate, lanceolate, acute, mucronulate, cartilaginous, ferruginous, pale-membranous at the margins, 4·5–5·5 mm. long; perianth subsessile, elliptic, 2·5–3 mm. long; segments acute, membranous, red-brown; the outer linear-oblanceolate; the lateral navicular, carinate; inner segments linear-lanceolate; female spikelets several or many, in spicate or panicled cymes, oblanceolate or oblong, 1·5–2 cm. long; spathes sheath-like but smaller; bracts loosely imbricate, lanceolate, acute, mucronulate, cartilaginous, red-brown, pale-membranous at the margins, 7–8 mm. long; perianth shortly and stoutly stipitate, usually entirely hidden by the bracts, orbicular, 2–2·5 mm. long; segments pale-membranous, or the outer lateral cartilaginous along the midrib and tinged brown on their upper parts; the outer-lateral linear-oblong, obtuse,

broadly winged; the anterior linear-lanceolate, obtuse; inner segments ovate, obtuse; ovary orbicular, smooth, surmounted by a single style.

South Africa: Cape Province—CAPE DIV.: flats near Cape Town, *Bolus*, 4436, ♂; flats near Rondebosch, *Bolus*, 7225, ♂; flats near Wynberg, *Schlechter*, 7538, ♂, 7539, ♀; flats between Diep River Station and Princess Vley, *Pillans*, 4361, ♂ and ♀; between Retreat Station and Lange Vley, *Wolley-Dod*, 2595, ♂ and ♀; near Retreat Station, *Pillans*, 4902, ♂ and ♀ (type); slopes of the Muizenberg, *Bolus*, 17206, ♂; Simon's Town Mts., *Guthrie*, 1316, ♀.—MALMESBURY DIV.: near Hopefield, *Bolus*, 12901, ♂.

19. T. dichotomus, *R. Br., Prodr. Fl. Nov. Holl.*, 244, adnot. (1810)!; *Spreng., Syst. Veg.*, i, 187 (1825), excl. syn. omn.; *Kunth, Enum.*, iii, 433 (1841), excl. syn. *R. nutans, R. vimineus, Schoenus capensis*; *Drège, Zwei Pfl. Documente*, 89 (1844); *Steud., Synops. Pl.*, ii, 259 (1855); *Mast. in Journ. Linn. Soc.*, x, 229 (1868), excl. syn. *T. consanguineus*; *in DC. Monog. Phan.*, i, 318 (1878), excl. syn. *T. consanguineus*; *Durand et Schinz, Consp. Fl. Afr.*, v, 518 (1895), excl. syn. *T. consanguineus*; *Mast. in Fl. Cap.*, vii, 124 (1897), excl. syn. *T. consanguineus*; *Marloth, Flora S. Afr.*, iv, 64, fig. 13c, tab. 16 (1915): **Restio dichotomus,** *Rottb., Progr.*, 10 (1772); *ejusd. Descr. et Ic.*, 2, tab. 1, fig. 1 (1773), excl. syn. mult.; *Linn., Syst. Veg.*, ed. *Murray*, 738 (1774); *Poir. in Lam., Encycl. Meth.*, vi, 167 (1804), excl. syn. *R. vimineus*; *Richter, Syst. Gen. et Sp. Pl.*, 970 (1840); *Mast. in Journ. Linn. Soc.*, xxi, 590, Nos. 8, 9 (1885): **R. Thamnochortus,** *Thunb., Diss.*, 15 (1788)!; *in Usteri, Delect.*, i, 50 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Willd., Sp. Pl.*, iv, pars ii, p. 722 (1806), excl. syn. *R. vimineus*; *Thunb., Fl. Cap.*, ed. 1, p. 328 (1811), excl. syn. *Rottb.*; ed. *Schultes*, 86 (1823), excl. syn. *Rottb.*; *Nees in Linnaea*, v, 649 (1830), excl. syn. *R. vimineus, R. nutans, Schoenus capensis et Juncus sp.*; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 420, No. 47 (1875): **R. lucens,** *Poir. in Lam., Encycl. Meth.*, vi, 169 (1804)!; *Spreng., Syst. Veg.*, i, 187; *Kunth, Enum.*, iii, 414; *Steud., Synops. Pl.*, ii, 254; *Mast. in Journ. Linn. Soc.*, viii, 254 (1865); *in DC. Monog. Phan.*, i, 296; *in Fl. Cap.*, vii, 98: **T. Ecklonianus,** *Kunth, Enum.*, iii, 430!: **T. bromoides,** *Kunth, Enum.*, iii, 432!: **T. dichotomus,** *R. Br.*, var. *leptochortus, Nees ex Drège in Linnaea*, xx, 241 (1847), absque descriptione.

Stems caespitose, erect, simple, rarely in the male with 1 or 2 fertile branches, slender and wiry, minutely white-speckled, usually 3–6 dm. high, less often 8–10 dm. high; barren stems generally accompanying the flowering, bearing numerous slender and compressed branchlets with subulate, foliaceous leaf-sheaths; sheaths on the flowering stems tightly convolute, lanceolate, acute or acuminate, subulate-mucronate, coriaceous, nervose-striate, membranous at the margins, soon becoming lacerate in the upper parts, mostly 3–4 cm. long; male inflorescence paniculate-cymose,

usually plume-like, 6–10 cm. long; spikelets spreading or cernuous, numerous, oblong or linear-oblong, 1–1·5 cm. long; spathes on the rhachis sheath-like but smaller; spathellae lanceolate, cartilaginous, membranous at the margins and in their upper parts, about half as long as or equalling the spikelets which they subtend; bracts loosely imbricate, oblong-lanceolate, mucronulate or mucronate, cartilaginous, membranous at the margins, 4–6 mm. long; perianth subsessile, obovate or elliptic, 2·5–3 mm. long; segments linear or linear-oblong, acute or obtuse, membranous, equal or subequal; the outer lateral navicular, slightly carinate, muticous or apiculate; female inflorescence spiciform or paniculate-cymose, mostly 4–8 cm. long, occasionally 1 dm. long; spathes conspicuous, sheath-like, erect, cartilaginous at base, membranous above, equalling to 3 times as long as the spikelets; spikelets 1–many, adjacent, or remote in the lower portion of the inflorescence, ovate, obovate or elliptical, 1–2·5 cm. long; bracts loosely imbricate or erect-spreading, oblong-lanceolate, acute or acuminate, mucronate, cartilaginous, membranous at the margins, 7–10 mm. long; perianth subsessile or shortly stipitate, orbicular or ovate-orbicular, 2·5–3·5 mm. long; outer lateral segments navicular, linear-lanceolate, obtuse, cartilaginous, with membranous wings that usually partly protrude beyond the sides of the bracts; anterior segment linear, subacute, membranous; inner segments ovate-lanceolate, obtuse, membranous, shorter or longer than the outer; ovary broadly obovate, minutely scabrid on its upper parts, surmounted by a single style.

South Africa: without precise locality, *Banks*, ♂, *Thunberg*, ♂, *Hooker*, ♂, *Forster*, ♂, *Lind*, ♂, *Boivin*, 498, ♂ and ♀, *Sieber*, 114, ♀, 116, ♂, 223, ♂, 225, ♂, *Thom*, 1030, ♂, *Verreaux*, ♂, *Menzies*, ♂, *Ludwig*, ♀, *Drège*, 137, ♂, *Berg*, ♂ and ♀, *Wahlberg*, ♂, *R. and T. Fries*, 3086, ♂.

Cape Province—Cape Div.: between Cape Town and Table Mt., *Burchell*, 924, ♀; Table Mt., *Drège*, 138*a*, ♀, *Rehmann*, 626, ♂, 628, ♀, 629, ♂, 1185, ♂, *Moss*, 7158, ♂ and ♀, 7848, ♂, 7851, ♀, *Marloth*, 3125, ♂ and ♀, 3128, ♂, *Tyson in Herb. Mus. Austr.-Afr.*, 6097, ♂, *Wolley-Dod*, 1367, ♂; Devil's Peak, *Bolus*, 4758, ♀, *Wilms*, 3799, ♂, *Rehmann*, 918, ♂; Blinkwater Ravine, *Rehmann*, 1222, ♀, *Schlechter*, 3800, ♀; Camp's Bay, *Burchell*, 333, ♂, *Zeyher*, 1741, ♀, *Pillans*, 4360, ♂ and ♀; Kirstenbosch, *Page in Bolus Herb.*, 17205, ♂ and ♀; Constantia Berg, *Schlechter*, 501, ♂; base of the Steenberg, *Pillans*, 2948, ♂, 2949, ♀; on the Steenberg, *Wolley-Dod*, 2584, ♂, 2585, ♀, 2586, ♀, 2590, ♂; on the Muizenberg, *Bolus*, 17204, ♂ and ♀; mountains above Simon's Town, *Guthrie*, 1315, ♂, *Wolley-Dod*, 2290, ♂, 2547, ♀, *Moss*, 7866, ♂ and ♀; "False Bay," *Robertson*, ♂.—Stellenbosch Div.: Sir Lowry's Pass, *Schlechter*, 4828, ♂, 7300, ♂, *Guthrie in Bolus Herb.*, 16623, ♀. —Malmesbury Div.: hills near Saron, *Schlechter*, 10656, ♂.—Paarl Div.: Kraaifontein, *Marloth*, 3178, ♀, 3179, ♂; French Hoek, *Pickstone*, 6, ♀,

7, ♀, 11, ♂, 12, ♂; Bain's Kloof, *Bolus*, 4091, ♀, 4102, ♀, 4105, ♂.—Tulbagh Div.: Tulbagh Kloof, *MacOwan in Herb. Austr.-Afr.*, 1678, ♂ and ♀.—Ceres Div.: mountains at Ceres, *Bolus*, 9673, ♀.—Van Rhyn's Dorp Div.: between Grasberg River and Waterval River, *Drège*, 135, ♂.—Calvinia Div.: between Groene River and Waterval, *Drège*, 9453, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 133, ♂ and ♀, *Tyson*, 841, ♀; Hex River Valley, *Tyson*, 605, ♀, 608, ♀.—Caledon Div.: mountains at Genadendal, *Burchell*, 7595, ♂, 8629, ♂, *Schlechter*, 10310, ♂, 10311, ♀; mountains near Grietje's Gat, *Ecklon and Zeyher*, ♂ and ♀; Steenbras, *Rogers*, 11139, ♀, 11140, ♂.

Some of the plants to which Nees von Esenbeck affixed his manuscript name "*Restio paleaceus*" in herbaria belong here.

Var. β, hyalinus (*Pillans*); stems stouter than those of the typical plant; bracts in the ♂ and ♀ plants broadly hyaline-membranous at the margins; female perianth 3·5–4 mm. long; the wings pale in their lower parts.

Cape Province—Riversdale Div.: Phisantefontein, north slopes of the Lange Bergen, *Muir*, 3191, ♂, 3192, ♀.

20. T. gracilis, *Mast. in DC. Monog. Phan.*, i, 327 (1878)!; *in Fl. Cap.*, vii, 129 (1897): **Staberoha gracilis,** *Durand et Schinz, Consp. Fl. Afr.*, v, 521 (1895).

Stems sporadic on creeping rhizomes or somewhat caespitose, erect, bearing a few flowering branches in their upper parts or simple on the same plant, slender and wiry, smooth, minutely white-speckled, usually 6–8 dm. high, 1–1·75 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acute, mucronate, coriaceous, nervose, ferruginous, soon becoming lacerate in their upper parts, mostly 2·5–3 cm. long; male spikelets numerous, in lax panicled cymes, oblong, oblanceolate or obovate, 7–12 mm. long; spathes and spathellae sheath-like but smaller; bracts loosely imbricate, lanceolate, acute, mucronate, cartilaginous, light brown, pale-membranous at the margins, 5–6 mm. long; perianth subsessile, rotundate, 2–3 mm. long; segments acute or obtuse, hyaline-membranous; the outer lateral navicular, linear-oblong, with a red-brown keel; the anterior lanceolate; the inner oblong-lanceolate, often toothed at the apex; female spikelets several or many, in paniculate or less often in spicate cymes, obovate or rotundate, cuneate at base, occasionally broadly oblong, mostly 1–1·5 cm. long; spathes sheath-like but smaller; spathellae lanceolate, acuminate, mucronate or aristate, coriaceous, each equalling or exceeding the spikelet which it subtends; bracts loosely imbricate, oblong-lanceolate, acute, mucronate or shortly aristate, cartilaginous, light brown, pale-membranous at the margins, 7–8 mm. long; perianth subsessile, orbicular, 2–3 mm. long; outer segments linear-oblong, obtuse or subacute, membranous; the lateral with wings 0·5–0·75 mm. in

diameter; inner segments oblong-lanceolate, obtuse, cartilaginous in the lower half, membranous in the upper; ovary broadly obovate, surmounted by a single style.

South Africa: Cape Province—Cape Div.: woods above Newlands House, *Wolley-Dod*, 2446, ♀; hills west of Simon's Town, *Pillans*, 3404, ♂ and ♀.—Caledon Div.: Hottentots Holland Mts., *Ecklon and Zeyher*, ♀; Baviaans Kloof, near Genadendal, *Burchell*, 7894 partly, ♀; Sandfontein, near the Zwartberg, *Schlechter*, 10348, ♂, 10349, ♀; Zwartberg, near Caledon, *Guthrie in Bolus Herb.*, 16074, ♂ and ♀.

21. T. erectus, *Mast. in Journ Linn. Soc.*, xiv, 419 (1875)!; *in DC. Monog. Phan.*, i, 321 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 519 (1895); *Mast. in Fl. Cap.*, vii, 125 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900): **Restio erectus,** *Thunb., Diss.*, 14 (1788)!; *in Usteri, Delect.*, i, 48 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Willd., Sp. Pl.*, iv, pars 2, p. 722 (1806); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, 325 (1811); ed. *Schultes*, 85 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 419 (1875): **R. elongatus,** *Thunb. in Hoffm. Phytogr. Blätter*, i, 7 (1803)!; *in Weber et Mohr, Archiv*, i, 25 (1804); *Pers., Synops. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, 318 (1807); *ibid.*, ed. *Schultes*, 83 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Kunth, Enum.*, iii, 408 (1841); *Steud., Synops. Pl.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 254 (1865); *op. cit.*, x, 279 (1868); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 416: **R. simplex,** *Steud. in Flora*, 1829, i, 134!, non *Forster nec Thunberg*: **R. Thamnochortus,** *Nees in Linnaea*, vii, 617 (1832), absque descript., non *Thunb.*: **T. floribundus,** *Kunth, Enum.*, iii, 435 (1841)!; *Steud., Synops. Pl.*, ii, 259; *Mast. in Journ. Linn. Soc.*, x, 231; *in DC. Monog. Phan.*, i, 328; *in Fl. Cap.*, vii, 130: **T. elongatus,** *Mast. in Journ. Linn. Soc.*, x, 226 (1868)!, quoad pl. fem., excl. syn. *R. nutans et T. dichotomus*; *ibid.*, xiv, 416, No. 9; *in DC. Monog. Phan.*, i, 320, partim; *Durand et Schinz, Consp. Fl. Afr.*, v, 519 (1895), excl. syn. *R. nutans et T. dichotomus*; *Mast. in Fl. Cap.*, vii, 123, partim: **T. scirpiformis,** *Mast. in Journ. Linn. Soc.*, x, 228 (1868); *in DC. Monog. Phan.*, i, 318; *Durand et Schinz, Consp. Fl. Afr.*, v, 520; *Mast. in Fl. Cap.*, vii, 121: **T. Burchellii,** *Mast. in DC. Monog. Phan.*, i, 322, tab. 2, figs. 16–27, tab. 5, fig. 8, *a* and *b* (1878)!; *Durand et Schinz, Consp. Fl. Afr.*, v, 518; *Mast. in Fl. Cap.*, vii, 126: **T. caricinus,** *Mast. in DC. Monog. Phan.*, i, 327 (1878)!; *in Fl. Cap.*, vii, 129: **Staberoha caricina,** *Durand et Schinz, Consp. Fl. Afr.*, v, 520 (1895)!.

Stems caespitose, erect, simple, rigid or rather slender, faintly wrinkled and pitted, occasionally minutely and closely yellow-speckled on the upper parts, 0·8–1·5 m. high, 2–2·5 mm. in diameter at the middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, striate, coriaceous, mem-

branous and eventually lacerate at the margins, 3·5–5 cm. long; male inflorescence an oblong or linear panicle, usually interrupted in the lower part, lax to dense, mostly 1–2 dm. long; rhachillae usually erect and erect-spreading, seldom spreading or cernuous, the lower commonly 6–10 cm. long; spathellae oblong-lanceolate, membraneous and lacerate in their upper parts; spikelets very numerous, adjacent, ovate and obtuse to linear-oblong and acute, many-flowered, 0·5–1·5 cm. long; bracts loosely imbricate, oblong, acute, mucronulate, coriaceous or cartilaginous, narrowly membranous at the margins, 3–3 5 mm. long; perianth sessile, usually slightly protruding beyond one side of the subtending bract, oblong, 2·25–3 mm. long; segments subequal, membranous, red-brown; the outer lateral navicular, slightly keeled, linear-oblong, obtuse, mucronate; the anterior linear acute; inner segments oblong-lanceolate acute, with pale margins; female inflorescence usually an oblong to linear panicle, sometimes spiciform but then shorter (3–5 cm. long), lax, interrupted in the lower part, mostly 1–1·5 dm. long; rhachillae erect to erect-spreading, usually 5 cm., often 10 cm. long in the lower part of the inflorescence, much reduced and bearing solitary spikelets in spiciform inflorescences; spathellae as in the male but larger; spikelets numerous, ovate, obovate or rotundate, many-flowered, light brown, 1·2–2 cm. long; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, coriaceous, narrowly membranous at the lower margins, 7–8 mm. long; perianth obscurely stipitate, partly protruding beyond one or both sides of the bract, orbicular, 3–5 mm. long; outer lateral segments lanceolate, obtuse, apiculate, navicular, wing-carinate, cartilaginous; keels membranous, up to 1 mm. in diameter; anterior segment oblong-lanceolate, obtuse, minutely apiculate, subequal with the lateral; inner segments oblong-lanceolate, obtuse, occasionally apiculate, cartilaginous, distinctly shorter than the outer; ovary ovate to orbicular, scabridulous or hispidulous on its upper parts, reddish.

South Africa: without precise locality, *Thunberg*, ♂, *Masson*, ♀, *R. Brown*, ♂, *Reynaud*, ♂, *Thom*, 900, ♂, 913, ♂, *Drège*, 129, ♂ and ♀, *Grey*, ♂, *Druce*, ♂ and ♀, *Bolus*, 7501, ♀.

Cape Province—Cape Div.: slopes of Table Mt., *Ecklon*, 838, ♀, *Moss*, 7852, ♂, 7853, ♀; Half-Way House, *Berg*, ♂; Camp Ground, Mowbray, *Pillans*, 4181, ♂ and ♀; Steenberg, *Wolley-Dod*, ♀; Kommetje, *Galpin*, 4814, ♂ and ♀; "False Bay," *Robertson*, ♂; mountains above Simon's Town, *Pillans*, 3407, ♂ and ♀; Black River Cottages, east of Mowbray, *Wolley-Dod*, 2712, ♀; Princess Vley, *MacOwan*, 1791, ♀; Cape Flats, *Ecklon*, 26, ♀, *Pappe in Herb. Mus. Austr.-Afr.*, 13000, ♂ and ♀, *Rehmann*, 1813, ♀, *Bolus*, 2282, ♂, 4446, ♀, 4449, ♂, 4450, ♀, *Wolley-Dod*, 2486, ♂, 2487, ♀, 2532, ♂, 2533, ♂, 2713, ♂.—Malmesbury Div.: Groene Kloof, *Ecklon and Zeyher*, ♀, *Bolus*, 4236, ♀, 4237, ♂.—Paarl Div.: Kraaifontein, *Marloth*, 3188, ♂

and ♀.—Caledon Div.: Steenbras, *Rogers*, 11139, ♂ and ♀; Hawston, *Schlechter*, 9466, ♂, 9467, ♀.—Clanwilliam Div.: Braakfontein, Olifants River Valley, *Zeyher*, ♂ and ♀.—Riversdale Div.: north end of Garcia's Pass, *Muir*, 3185, ♂, 3186, ♀.—George Div.: Great Brak River, *Schlechter*, 5730, ♂, 5731, ♀.—Mossel Bay Div.: between Great and Little Brak Rivers, *Burchell*, 6169, ♂ and ♀.—Oudtshoorn Div.: without precise locality, *Rogers*, 4255, ♂.—Knysna Div.: Ruigte Vley, *Fourcade*, 1569, ♀.

Some of the herbarium specimens to which Nees von Esenbeck gave his manuscript names, "*Restio paleaceus*" and "*R. sulcatus*," belong here, as also does a plant in the Brit. Mus. collected by Masson, to which he gave a manuscript name, "*Restio caricinus*."

22. T. insignis, *Mast. in Gard. Chron.*, xxv, 242, fig. 93 (1899) !.

Stems caespitose, erect, rigid, simple, smooth, minutely white-speckled, 1–2 m. high, about 4 mm. in diameter at the middle; sheaths tightly convolute, oblong-lanceolate, acuminate, mucronate, coriaceous, soon lacerate at the margins, nervose-striate, 2–5 cm. long at the base of the inflorescence; male inflorescence a lax plume-like panicle, 8–15 cm. long; spikelets very numerous, erect, spreading or cernuous, oblong to linear-oblong, 5-sided, many-flowered, 0·8–2 cm. long; bracts quinquefarius, loosely imbricate, oblong-lanceolate, acute mucronulate, red-brown, 3–4 mm. long; perianth sessile, oblong-lanceolate, 2·5–3 mm. long; segments membranous, red-brown; the outer lateral navicular, linear-oblong, obtuse, apiculate; the anterior linear, acute, shorter; inner segments lanceolate-oblong, subacute, shorter than the outer; female inflorescence a narrow panicle, rarely reduced to a spicate cyme, 2–4 dm. long; spikelets numerous, ovate to oblong, cuneate at base, many-flowered, 1·8–3 cm. long; spathes sheath-like but smaller; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, coriaceous, ferruginous, about 8 mm. long; perianth hidden, orbicular, 2·75–4 mm. long; outer lateral segments navicular, linear-oblong, obtuse, cartilaginous, broadly winged on the dorsal angle, 1·5 mm. in depth; anterior segment linear-lanceolate, subacute; inner segments lanceolate, membranous, shorter than the outer; ovary obovoid, surmounted by a solitary style.

South Africa: Cape Province—Riversdale Div.: Riversdale, *Rust*, 399*a*, ♀, 406, ♀; the Downs, *Muir*, 3106, ♂, 3107, ♀, 3111, ♂ and ♀; Melkhoutfontein, *Muir*, 3112, ♂ and ♀.

23. T. spicigerus, *R. Br., Prodr. Fl. Nov. Holl.*, 244, adnot. (1810); *Spreng., Syst. Veg.*, i, 187 (1825); *Kunth, Enum.*, iii, 440 (1841); *Drège, Zwei Pfl. Documente*, 112 (1844); *Steud., Synops. Pl.*, ii, 260 (1855); *Mast. in Journ. Linn. Soc.*, x, 228 (1868); *in DC. Monog. Phan.*, i, 314 (1878); *in Journ. Linn. Soc.*, xxi, 591, Nos. 22 and 25 (1885); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § iv, p. 4, tab. (1888); *Durand et Schinz, Consp.*

Fl. Afr., v, 520 (1895); *Mast. in Fl. Cap.*, vii, 121 (1897); *Marloth, Flora S. Afr.*, iv, p. 64, tab. 17, A (1915): **Restio spicigerus,** *Thunb., Diss.*, 11, figs. 5 et 6 (1788)!; *in Usteri, Delect.*, i, 46, tab. 2, figs. 5 et 6 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 175 (1804), partim; *Willd., Sp. Pl.*, iv, pars 2, p. 720 (1806); *Thunb., Fl. Cap.*, 321 (1811); *ed. Schultes*, 84 (1823); *Nees in Linnaea*, v, 647 (1830), excl. syn. *R. imbricatus et Leptocarpus imbricatus*; *ibid.*, vii, 616 (1832), excl. var. β et syn. *Willdenowia teres*; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 419, 420 (1875): **T. elongatus,** *Hochst. in Flora*, 1845, p. 339!: **T. striatus,** *Hochst., loc. cit.*!; *Steud., Synops. Pl.*, ii, 260; *Mast. in Journ. Linn. Soc.*, x, 231; *in DC. Monog. Phan.*, i, 323; *Durand et Schinz, Consp. Fl. Afr.*, v, 520; *Mast. in Fl. Cap.*, vii, 130: **T. maximus,** *O. Kuntze, Rev. Gen. Pl.*, iii, 330 (1893)!.

Stems caespitose, erect, simple, rigid, smooth or obscurely wrinkled, 1–2 m. high, 3·5–5 mm. in diameter at the middle; sheaths tightly convolute, oblong, acute or acuminate, mucronate, coriaceous, narrowly membranous at the margins, ultimately lacerate at the upper margins, red-brown, 3·5–5 cm. long on the middle part of the stems; male inflorescence a lax, plume-like panicle, usually 2–3 dm. long, up to 6 dm.; rhachillae erect-spreading or pendulous, mostly 5–8 cm. long; spikelets very numerous, oblong, obtuse, cuneate at base, many-flowered, mostly 1–1·2 cm. long; bracts erect-spreading, loosely convolute, ovate-oblong, acute, cartilaginous, ferruginous, 2·5–3 mm. long; perianth subsessile, partly protruding beyond the apices of the bracts, ovate, 2·75–3 mm. long; outer lateral segments navicular, lanceolate, acute, cartilaginous; the anterior segment linear, obtuse; inner segments lanceolate, truncate or obtuse, membranous, brown, shortly exceeding the outer; female inflorescence a linear panicle, interrupted in the lower part, equalling the male; rhachillae erect, 3–10 cm. long, each bearing 1–8 spikelets; spikelets numerous, elliptic-oblong or ovate-oblong, cuneate at base, obtuse at apex, dark brown, 1·5–2·5 cm. long; bracts erect-spreading, oblong-lanceolate, acute, mucronulate, coriaceous, 7–9 mm. long; perianth sessile, partly protruding beyond the sides of the bracts, orbicular, 4·5–5 mm. long; outer lateral segments navicular, linear-lanceolate, acute, mucronate, broadly winged on the dorsal angle, cartilaginous, 2 mm. in depth; anterior segment lanceolate, acute, equalling the lateral; inner segments subacute, cartilaginous, membranous at the margins, distinctly shorter than the outer; the lateral oblong-deltoid; the posterior ovate-deltoid; ovary suborbicular, hispidulous on its summit, pale red, surmounted by a solitary style.

South Africa: without precise locality, *Oldenburg*, ♀, *Thunberg*, ♂ and ♀, *Masson*, ♂, *Mund*, ♀, *Grey*, ♂ and ♀.

Cape Province—Cape Div.: between Paarden Island, Blauwberg and

Tiger Berg, *Drège*, 227, ♂ and ♀; Cape Flats, *Ecklon and Zeyher in Herb. Mus. Austr.-Afr.*, 13001, ♂ and ♀, *Pappe in Herb. Mus. Austr.-Afr.*, 12847, ♂ and ♀, *Wolley-Dod*, 1364, ♀, 2534, ♂, *Pillans*, 3408, ♂ and ♀; Diep River, *O. Kuntze*, ♂ and ♀; Bellville, *Marloth*, 3189, ♂.—MALMESBURY DIV.: Hopefield, *Rehmann*, 213, ♀, *Hans Schinz*, 1849, ♂; St. Helena Bay, *Hove*, ♂.—KNYSNA DIV.: Groene Vley, *Burchell*, 5649, ♂.

VI, STABEROHA, *Kunth, Enum.*, iii, 442 (1841); *Meisner, Gen. Pl.*, 408 (1842); *Endl., Gen. Pl.*, Suppl. 2, p. 11 (1842); *Steud., Synops. Pl.*, ii, 257 (1855); *Benth. et Hook., Gen. Pl.*, iii, 1034 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 9 (1888).

Flowers dioecious. Male spikelets several or many in panicled cymes, occasionally solitary and terminal, often spreading or cernuous, obovate, oblong, turbinate or suborbicular, terete, compact, many-flowered. Perianth compressed; segments 6, equal or subequal, the outer lateral navicular, carinate. Anthers oblong, apiculate. Rudimentary ovary minute. Female spikelets erect, solitary and terminal, geminate or several in spicate cymes or occasionally in panicles, lanceolate or oblong, many-flowered. Perianth compressed; segments 6, the outer lateral navicular, keeled or amply winged along the median nerve. Staminodes minute. Ovary compressed, 1-celled; styles 2 or 3, free or 2 connate at base. Fruit compressed, indehiscent.

Flowering stems tufted or on creeping rhizomes, erect, slender, simple, terete. Leaf-sheaths closely convolute, persistent. Barren stems often present, shorter, much-branched.

The genus is endemic.

Key based on Characters in the Female Plants.

Outer-lateral perianth-segments keeled:
- Bracts 6–10 mm. long; perianth 2–2·5 mm. long . . . . (1) *vaginata.*
- Bracts 12–15 mm. long; perianth 3–3·5 mm. long . . . . (2) *Banksii.*

Outer-lateral perianth-segments winged:
- Perianth-segments acute; wings of the outer-lateral segments 1·25–2 mm. in diam., (5) *distachya.*
- Perianth-segments obtuse; wings of the outer-lateral segments not exceeding 1 mm. in diameter:
  - Perianth 3–5 mm. long; wings entire or crenate, 0·5–0·75 mm. in diam.; styles thickened in their lower parts . . . . . (3) *aemula.*
  - Perianth 2·5–3 mm. long; wings considerably lacerated, 0·5–1 mm. in diam.; styles not thickened in their lower parts . . . . . (4) *cernua.*

1. S. vaginata, *Pillans*, comb. nov.: **Restio vaginatus,** *Thunb., Diss.*, 10 (1788)!; *in Usteri, Delect.*, i, 44 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 173 (1804); *Willd., Sp. Pl.*, iv, pars 2,

719 (1806); *Pers., Syn. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 317 (1811); ed. *Schultes*, 83 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Nees in Linnaea*, v, 636 (1830); *Kunth, Enum.*, iii, 408 (1841), excl. syn. *Nees et Steudel*; *Steud., Synops.*, ii, 250 (1855); *Mast. in Journ. Linn. Soc.*, viii, 250 (1865), excl. cit. *Hochst.* et syn. *R. pseudoleptocarpus.*

Stems caespitose, erect, simple, straight, wiry, terete, tubercled, 5–7 dm. high, scarcely 1 mm. in diameter at middle; sheaths tightly convolute, lanceolate-oblong or linear-oblong, subacute or obtuse, with a caducous mucro, coriaceous, purple-brown, yellow-speckled, 2·5–4 cm. long; male spikelets 2–6, in panicled cymes, cernuous, obovate or oblong, terete, cuneate at base, rounded at apex, 1–1·8 cm. long; spathe sheath-like, embracing the base of the inflorescence; bracts loosely imbricate, oblong-obovate, rounded at the upper end, abruptly and shortly acute, mucronulate, cartilaginous, strongly nervose, scabridous on exposed parts, purplish, pale-membranous at the margins, about 6 mm. long; perianth sessile, elliptical, 4 mm. long; outer segments linear-oblong, acute, cartilaginous, reddish; the lateral navicular, slightly carinate; the inner oblong-lanceolate, acute or subacute, membranous, about equalling the outer in length; female spikelets 1–5, in spicate or panicled cymes, adjacent, erect, linear-lanceolate or linear-oblong, tapered at both ends, terete, 1·5–3·5 cm. long; spathes sheath-like but shorter and broader, each about half as long as its subtended spikelet; bracts loosely imbricate, broadly oblong, acute, mucronulate, coriaceous, dorsally scabridous, dark purple, paler and membranous at the margins, 6–10 mm. long; perianth sessile, elliptic or rotundate, red-brown, 2–2·5 mm. long; outer segments oblong or ovate-oblong, obtuse, membranous; the lateral carinate, often emarginate at apex; inner segments oblong-ovate, obtuse, membranous, about equal with the outer in length; ovary obovate, smooth, pale; styles 2 or 3, free or 2 are united at base.

South Africa : without precise locality, *Thunberg*, ♀.

Cape Province—Cape Div.: Table Mt., *Bolus*, 4455, ♀; opposite mouth of Waai Vley, on Table Mt., *Wolley-Dod*, 3246, ♀; head of Waai Vley, *Pillans*, 4896, ♂ and ♀, 4901, ♂ and ♀.

2. S. Banksii, *Pillans*, sp. nov.; culmis erectis simplicibus teretibus rugosis; vaginis arcte convolutis lineari-oblongis acutis mucronatis coriaceis; spiculis masculis cernuis obovatis vel turbiniformibus in cymas paniculatas dispositis; bracteis laxe imbricatis oblongis mucronulatis cartilagineis purpureis; perianthio sessile elliptico compresso; segmentis exterioribus lineari-oblongis acutis membranaceis; lateralibus navicularibus; segmentis interioribus oblongo-lanceolatis acutis; spiculis femineis 1–3 erectis oblongis vel lanceolatis in spicatas cymas dispositis; bracteis laxe imbricatis deltoideo-ovatis acutis mucronulatis coriaceis purpureis; perianthio sessili elliptico; segmentis oblongis membranaceis ferrugineis

subaequalibus ; exterioribus ad apicem obtusis ; lateralibus parum carinatis ; segmentis interioribus obtusis vel subacutis ; ovario obovato compresso ; stylis 2 interdum 3 liberis.

Stems caespitose, erect, simple, slender but firm in their lower parts, terete, somewhat fistular, rugose, 4–8 dm. high, 1–1·5 mm. in diameter at the middle ; sheaths tightly convolute, linear-oblong, acute, mucronate, rugulose and nervose on the outer surface, coriaceous, purple-brown, yellow-speckled, brown-membranous at the margins, mostly 2·5–3·5 cm. long ; male inflorescence paniculate-cymose, lax, 5–15 cm. long, with the spreading or declinate, compressed branches arising from one or two nodes on the erect rhachis ; spathes sheath-like ; spikelets cernuous or nearly so, obovate or turbinate, rounded at the apex, terete, 1–1·5 cm. long ; bracts loosely imbricate, oblong or spathulate-oblong, obtuse, mucronulate, cartilaginous, dorsally scabridous, purplish, narrowly pale-membranous at the margins, 6–7 mm. long ; perianth sessile, elliptical, 4–4·5 mm. long ; outer segments linear-oblong, acute, membranous, reddish ; the lateral navicular, slightly keeled ; inner segments oblong-lanceolate, acute, membranous, pale-reddish, little shorter than the outer ; female spikelets 1–3, adjacent in spicate cymes, erect, oblong or lanceolate, tapered at both ends, 2·5–4 cm. long ; spathes sheath-like but broader and shorter, clasping the bases of the spikelets ; bracts loosely imbricate, deltoid-ovate, acute, mucronulate, coriaceous, dorsally scabridous, purple, pale-membranous at the margins, 1·2–1·5 cm. long ; perianth sessile, elliptical, 3–3·5 mm. long ; segments oblong, membranous, brown, subequal ; the outer rounded at apex ; the lateral narrowly keeled ; inner segments obtuse or subacute ; ovary obovate, compressed, cartilaginous and pale along its upper edge ; styles 2 or occasionally 3, free, about 4 mm. long.

South Africa : without precise locality, *Banks*, ♂, *Verreaux*, ♂ and ♀.

Cape Province—Cape Div. : between Wynberg and Constantia, *Burchell*, 789, ♂ ; Cape Flats, *Burke*, ♂, *Zeyher*, ♂ ; on the Muizenberg, *Moss*, 845, ♀, 846, ♂, 847, ♂ ; mountains near Simon's Town, *Pillans*, 3405, ♂ and ♀ ; rocks by Smitswinkel Bay, *Wolley-Dod*, 2548, ♂, 2549, ♀ ; Princess Vley, *MacOwan*, 1789, ♂.—Malmesbury Div. : Mamre, *Baur*, 1180, ♂.—Caledon Div. : Zoetmelks Vley, *Wallich*, ♀.

3. S. aemula, *Pillans*, comb. nov. : **Thamnochortus aemulus,** *Kunth, Enum.*, iii, 439 (1841) ! ; *Drège, Zwei Pfl. Documente*, 82 (1844) : **S. stenoptera,** *Kunth, op. cit.*, 443 ! ; *Drège, loc. cit.* ; *Steud., Synops.*, ii, 257 (1855) : **Restio tetrasepalus,** *Steud., op. cit.*, 251 ! : **T. imbricatus,** *Mast.* var. *stenopterus, Mast. in Journ. Linn. Soc.*, x, 231 (1868) !, excl. syn. *R. simplex* ; *in Fl. Cap.*, vii, 127 (1897), excl. syn. *R. vaginatus* : **S. imbricata,** *Kunth*, var. *stenoptera, Durand et Schinz, Consp. Fl. Afr.*, v, 521 (1895), excl. syn. *R. vaginatus, Thunb.*

Stems densely caespitose, erect, simple, wiry, rugose or tubercled on the lower parts, 3–5 dm. high, 1 mm. in diameter; sheaths tightly convolute, oblong-lanceolate, acute, coriaceous, cartilaginous at the margins, nervose, ferruginous, yellow-speckled, 3–5 cm. long, with a deciduous mucro; male inflorescence paniculate-cymose, 2–3 cm. long; spikelets 2–4, appearing as though pedunculate, cernuous, broadly turbinate, narrowed at base, rounded at apex, 1·5–2 cm. long; spathes bract-like, clasping the bases of the spikelets; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, cartilaginous, membranous at the margins, dorsally scabridous with raised cells, ferruginous, 1–1·3 cm. long; perianth sessile, lanceolate, 5–6 mm. long; segments linear-lanceolate, acute, submembranous; the outer lateral navicular, with a cartilaginous keel; inner segments shorter; female inflorescence spiciform, with one terminal spikelet or two adjacent spikelets; spikelets erect, lanceolate in outline, terete, acute at apex, 2·5–3·5 cm. long; spathes bract-like; bracts loosely imbricate, oblong-lanceolate, acute, mucronulate, coriaceous, thinner at the margins, ferruginous, 1·4–1·8 cm. long; perianth sessile, ovate-oblong, 3–5 mm. long; segments linear-lanceolate or linear-oblong, obtuse, coriaceous, pale; the outer lateral navicular, with a narrow wing; ovary ovate, surmounted by a horny cap; styles 2, erect, shortly united at base or occasionally free, with their lower parts persistent, rigid, and distinctly thickened.

South Africa : without precise locality, *Wallich*, ♂.

Cape Province—Caledon Div.: mountains near mouth of Palmiet River, *Stokoe in Bolus Herb.*, 17892, ♂.—Tulbagh Div.: peak below Great Winterhoek, *Phillips*, 1652, ♀, 1653, ♂.—Ceres Div.: Skurfde Bergen at Wagenbooms River, Koude Bokkeveld, *Schlechter*, 10164, ♂, 10165, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 27, ♀, 1636, ♀, 1652, ♂; Onklaarberg, *Stokoe*, 1203, ♂.—Clanwilliam Div.: Cedar Berg, *Primos in Marloth Herb.*, 11791, ♀, 11792, ♂.

4. S. cernua, *Durand et Schinz, Consp. Fl. Afr.*, v, 520 (1895), excl. syn. *Restio spicigerus*, Lam.: **Restio cernuus,** *Linn. fil., Suppl. Pl. Syst. Veg.*, 425 (1781)!; *Linn., Syst. Veg.*, ed. 14, p. 882 (1784); *Thunb., Diss.*, 10, fig. 2 (1788); *in Usteri, Delect.*, i, 45 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Linn., Syst. Veg.*, ed. 15, p. 925 (1797); *Poir. in Lam., Encycl. Meth.*, vi, 174 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 720 (1806); *Pers., Synops. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, 319 (1811); ed. *Schultes*, 85 (1823); *Nees in Linnaea*, v, 648 (1830); *op. cit.*, vii, 616 (1832), excl. syn. *R. umbellatus*: **Thamnochortus cernuus,** *Kunth, Enum.*, iii, 439 (1841); *Steud., Synops.*, ii, 260 (1855), excl. syn. *Lamarck*; *Mast. in Journ. Linn. Soc.*, x, 232 (1868), excl. syn. *R. spicigerus*; *op. cit.*, xiv, 415, No. 6 (1875); *in DC. Monog. Phan.*, i, 325, tab. 2, figs. 28–37, t. 5, figs. *c*, *d* (1878), excl. syn. *Lam.*; *in Fl. Cap.*, vii, 128 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 11 (1900):

Restio umbellatus, *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 415, No. 4 (1875) !, non *Thunb. Diss.*

Stems caespitose, erect, simple, slender, closely studded with discoid tubercles, 4–6 dm. high, 0·75–1 mm. in diameter at the middle; sheaths tightly convolute, oblong-lanceolate, acute, with a slender mucro, nervose, obsoletely tubercled, coriaceous, membranous at the upper margins, brown, yellow-speckled, 1·5–2·5 cm. long; male inflorescence paniculate-cymose, 2–3 cm. long; spikelets 1–several, cernuous, sessile on slender, compressed branches of the cymes, at first turbinate, becoming suborbicular, 8–14 mm. long; spathes oblong-lanceolate, obtuse, mucronate, coriaceous, each slightly shorter than or longer than the spikelet which it subtends; bracts loosely imbricate, oblong-lanceolate, obtuse, mucronulate, cartilaginous, ferruginous, about 6 mm. long; perianth sessile ovate-oblong, 3·25–3·5 mm. long; segments lanceolate, subacute, membranous, equal; the outer lateral navicular, with a narrow keel which usually bears a few reversed teeth; female inflorescence spicate- or less often paniculate-cymose, 1·5–5 cm. long; spathes erect, oblong-lanceolate, acute, mucronate, coriaceous, membranous at the margins, ferruginous, each shorter than or subequalling the spikelet which it subtends; spikelets 1–3, erect, adjacent, oblong-lanceolate or oblong, always cuneate in the lower ⅓ or ½, and shortly tapered at the apex, 1·5–2·5 cm. long; bracts loosely convolute, oblong-lanceolate, obtuse, mucronulate, coriaceous, ferruginous, about 1 cm. long; perianth sessile, ovate-oblong, 2·5–3 mm. long; segments linear-oblong, obtuse, membranous, equal; the outer lateral navicular, dorsally winged; wings finely lacerate at the margins, hyaline, 0·5–1 mm. in diameter; ovary turbinate; styles 3, rarely 2, adjacent, free or 2 are more or less united in their lower parts.

South Africa: without precise locality, *Thunberg*, ♂, *R. Brown*, ♂, *Verreaux*, ♂, *Berg*, ♂, *Thom*, 917, ♂, *Drège*, 23, ♂, 29, ♀, *Gill in Hooker's Herb.*, ♀, *Ecklon and Zeyher*, ♂.

Cape Province—Cape Div.: Table Mt., *Ecklon*, 841, ♂, *MacGillivray*, 434, ♂, *Rehmann*, 621, ♂, *Scott-Elliot*, 140, ♂, *Marloth*, 3116, ♀, 3117, ♂ and ♀; near Cape Town, *Bolus*, 2881, ♂; Camp's Bay, *Burchell*, 340, ♂ and ♀, *Wilms*, 3805, ♂; Devil's Peak, *Rehmann*, 916, ♂, 923, ♀, 927, ♀; Mowbray Flats, *Guthrie*, 1293, ♂; Kirstenbosch Ridge, *Pillans*, 4781, ♂; Steenberg, *Wolley-Dod*, 1269, ♂; on the Muizenberg, *Moss*, 7843, ♂; hills about Simon's Town, *Milne*, 217, ♂, *Wolley-Dod*, 2804, ♂ and ♀, *Rogers*, 11214, ♂, *Kensit in S.A. Nat. Herb.*, 1020, ♂, *Moss*, 7867, ♀; between Schoester's Kraal and Smitswinkel Vley, *Wolley-Dod*, 2715, ♀; Cape Flats, *Burchell*, 196, ♀, *Drège*, 368, ♂; Wynberg, *Alexander*, ♂; Kenilworth, *O. Kuntze*, ♂.—Stellenbosch Div.: Sir Lowry's Pass, *O. Kuntze*, ♂.—Caledon Div.: Zwartberg, *Pappe in Herb. Mus. Austr.-Afr.*, 12855, ♀, *Schlechter*, 5564, ♀;

Steenbras, *Rogers*, 11068, ♂.—Paarl Div.: mountains at French Hoek, *Phillips*, 1364, ♂, 1365, ♀, *Pickstone*, 44, ♂; Bain's Kloof, *Bolus*, 4103, ♂.—Ceres Div.: Mitchell's Pass, *Bolus*, 9670, ♂, 9671, ♀.—Worcester Div.: Du Toit's Kloof, *Bolus*, 7503, ♀; Onklaarberg, *Stokoe*, 1202, ♂, 1209, ♀.—Riversdale Div.: lower part of Lange Bergen, near Kampsche Berg, *Burchell*, 6963, ♂ and ♀, *Muir*, 3300, ♂; Garcia's Pass, *Bolus*, 15260, ♀, *Galpin*, 4815, ♂ and ♀; Albertinia, *Rogers*, 4108 partly, ♂.

5. S. distachya, *Kunth, Enum.*, iii, 444 (1841); *Steud., Synops.*, ii, 257 (1855); *Durand et Schinz, Consp. Fl. Afr.*, v, 520 (1895): **Restio distachyus,** *Rottb., Descr. et Icon.*, 8, tab. 3, fig. 5 (1773); *Poir. in Lam., Encycl. Meth.*, vi, 174 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 719 (1806); *Pers., Syn. Pl.*, ii, 606 (1807); *Nees in Linnaea*, v, 648 (1830): **R. imbricatus,** *Thunb., Diss.*, 9, fig. 1 (1788)!; *in Usteri, Delect.*, i, 43, tab. 2, fig. 1 (1790); *ejusd. Prodr. Pl. Cap.*, 14 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 173 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 718 (1806); *Pers., Syn. Pl.*, ii, 606; *Thunb., Fl. Cap.*, ed. 1, 316 (1811); ed. *Schultes*, 83 (1823); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 421 (1875): **R. umbellatus,** *Thunb., Diss.*, 11, fig. 3 (1788)!; *in Usteri, Delect.*, i, 45; *ejusd. Prodr. Cap.*, 15; *Poir. in Lam., Encycl. Meth.*, vi, 175; *Willd., Sp. Pl.*, iv, pars 2, 720; *Pers., Syn. Pl.*, ii, 606; *Thunb., Fl. Cap.*, ed. 1, 320; *ibid.*, ed. *Schultes*, 84 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 415, non *Thamnochortus cernuus, Kunth*: **Leptocarpus distachyus,** *R. Br., Prodr. Fl. Nov. Holl.*, 250 (1810); *Spreng., Syst. Veg.*, i, 187: **L. imbricatus,** *R. Br., op. cit.*, 250; *Spreng., loc. cit.*: ? **R. spicifer,** *Poir. in Lam., Tableau*, iii, 399 (1823); [*Lam., Ill.*, tab. 804, fig. 2 (1798)]: **R. spicigerus,** *β, culmo monostachyo, Nees in Linnaea*, v, 647 (1830), non *Thunb.*: **Thamnochortus umbellatus,** *Kunth, Enum.*, iii, 440 (1841); *Steud., Synops.*, ii, 260 (1855); *Mast. in Journ. Linn. Soc.*, x, 232 (1868), partim, excl. syn. *Rottb., Br., Kunth*; *in DC. Monog. Phan.*, i, 324 (1878), partim, excl. syn. mult.; *in Fl. Cap.*, vii, 126 (1897), partim, excl. syn. mult.: **Staberoha imbricata,** *Kunth, Enum.*, iii, 442; *Steud., Synops.*, ii, 257; *Durand et Schinz, Consp. Fl. Afr.*, v, 521, excl. syn. *Thamnochortus aemulus, Kunth*: **T. imbricatus,** *Mast. in Journ. Linn. Soc.*, x, 231!, excl. syn. *T. aemulus, Kth.*; *op. cit.*, xiv, p. 415, No. 5, p. 421; *in DC. Monog. Phan.*, i, 323, excl. syn. *T. aemulus*; *in Journ. Linn. Soc.*, xxi, 590, No. 11 (1885); *in Fl. Cap.*, vii. 127, excl. *T. aemulus.*

Stems caespitose or arising along creeping rhizomes, erect, simple, slender and wiry, wrinkled, minutely pale-speckled, 6–10 dm. high, 1·25–1·75 mm. in diameter at middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, wrinkled on their lower parts, nervose on the upper, ferruginous, pale-speckled, 2·5–3·5 cm. long; male inflorescence laxly paniculate-cymose, 3–6 cm. long; spathes sheath-like but much

smaller; spikelets several or many, cernuous, broadly obovate, 1–1·3 cm. long; bracts loosely imbricate, oblong, obtuse or subacute, muticous, chartaceous, 5·5 mm. long; perianth sessile, ovate, 3·5 mm. long; segments lanceolate, acute, membranous, reddish, equal; the lateral navicular, distinctly carinate, apiculate, serrate on the upper part of the carina; female spikelets 1 or 2, sessile, erect, oblong-lanceolate or cylindric, narrowed at the apex, 2–4·5 cm. long; spathe bract-like, embracing the base of the spikelet; bracts rather loosely convolute, at length squarrose in their upper parts, broadly ovate-lanceolate, acute, mucronate, coriaceous, nervose, ferruginous, 1·1–1·2 cm. long; perianth sessile, ovate, obovate or ovate-oblong, 3·5–5 mm. long; segments linear-lanceolate, acute, membranous or subcartilaginous, shortly and finely lacerate along the margins, subequal or the anterior distinctly longest; the outer lateral dorsally winged along the median nerve; wings semiorbicular or broadest in the upper or the lower half, entire, crenate or deeply lacerate, ferruginous or pale, 1·25–2 mm. in diameter; ovary oblong, with a dorsally compressed, hard cap; styles 2, adjacent or shortly united at base.

South Africa: without precise locality, *Thunberg*, ♀ and ♂, *Lind*, ♀, *Admiral Grey*, ♀.

Cape Province—Cape Div.: Table Mt., *Milne*, 227, ♀; Black River, near Mowbray, *Bolus*, 4430, ♀; flats near Wynberg, *Pappe in Herb. Mus. Austr.-Afr.*, 13013, ♀; Cape Flats, *Bolus*, 4239, ♂, 4451, ♀; Kommetje, *Galpin*, 4816, ♀; "Simon's Bay," *MacGillivray*, ♀; Red Hill, *Rogers*, 11214, ♀.—Malmesbury Div.: Groene Kloof, *Bolus*, 4238, ♀; Hopefield, *Bolus*, 12899, ♂, 12900, ♀.—Stellenbosch Div.: flats at Hottentots Holland, *Pappe in Herb. Mus. Austr.-Afr.*, 13014, ♀.—Paarl Div.: French Hoek, *Schlechter*, 9339, ♂, 9340, ♀; Kraaifontein, *Marloth*, 3184, ♀.—Caledon Div.: Hottentots Holland Mts., *Zeyher*, ♀; between Genadendal and Donkerhoek, *Burchell*, 7931, ♀; Steenbras, *Rogers*, 11069, ♂; Hermanus, *Burtt-Davy*, 18619, ♀.—Ceres Div.: Ceres, *Bolus*, 7458, ♀; Mitchell's Pass, *Bolus*, 9672, ♀.—Worcester Div.: mountains above Worcester, *Rehmann*, 2557, ♀; along the Breede River at Darling Bridge, *Bolus*, 2880, ♂ and ♀.—Clanwilliam Div.: Cedar Berg, *Drège*, 2511, ♀.—Riversdale Div.: Albertinia, *Rogers*, 4108 partly, ♀.—Mossel Bay Div.: between Mossel Bay and Zout River, *Burchell*, 6319, ♂ and ♀.

VII, HYPOLAENA, *R. Br., Prodr. Fl. Nov. Holl.*, p. 251 (1810); *Linn., Syst. Veg.*, ed. 16, i, p. 129 (1825); *Nees in Linnaea*, v, 663 (1830); *Endl., Gen. Pl.*, 121 (1836); *Harvey, Gen. S. Afr. Pl.*, 356 (1838); *Kunth, Enum.*, iii, 450 (1841); *Meisner, Gen. Pl.*, 409 (1842); *Nees in Lehm. Pl. Preiss.*, ii, 69 (1846); *Steud., Synops. Pl.*, ii, 264 (1855); *Harv., Gen. S. Afr. Pl.*, ed. 2, p. 415 (1868); *Mast. in Journ. Linn. Soc.*, x, 262 (1868);

Bentham, Fl. Australia, vii, 237 (1878); *Mast. in DC. Monog. Phan.*, i, 364, tab. iv, figs. 1–6 (1878); *Benth. et Hook., Gen. Pl.*, iii, 1035 (1883); *Hieron. in Engl. et Prantl, Natur. Pflanzen*, ii, § 4, p. 9 (1888); *Mast. in Fl. Cap.*, vii, 130 (1897); *N. E. Brown in Fl. Trop. Afr.*, viii, 265 (1901).

Flowers dioecious. Male spikelets few or many in spicate or panicled cymes, 1–many-flowered. Perianth compressed, subterete or trigonous; segments 6, sometimes imperfectly developed or absent. Anthers oblong, apiculate. Rudimentary ovary minute. Female spikelets solitary or several in a spicate cyme, terete, with several empty bracts, with one fertile flower occupying a terminal position. Perianth usually stipitate, rarely sessile, terete; segments 6, the inner sometimes imperfectly developed, or only the 3 outer present. Staminodes minute or absent. Ovary oblong, terete or slightly compressed, often with a hard cap, 1-celled. Styles 2, free or connate in their lower parts. Fruit oblong or elliptical, terete, indehiscent.

Flowering stems tufted or less often arising from creeping rhizomes, erect or occasionally reclining at base, branched, terete or compressed. Leaf-sheaths persistent, rarely produced into a foliaceous mucro.

The genus occurs also in Australia and New Zealand.

Key based on Characters in the Female Plants.

Main stems compressed throughout their length . . . . . (6) *graminifolia.*
Main stems compressed in their lower parts, subterete or terete in their upper, (5) *laxiflora.*
Main stems terete throughout their length:
  Stems studded with small whitish tubercles throughout their length . . (4) *diffusa.*
  Stems more or less striate on their lower parts, wrinkled and punctate on their middle and upper parts:
    Perianth sessile; styles shortly united at base . . . . . (1) *digitata.*
    Perianth on a stout, obscurely 6-lobed stipe; styles free . . (2) *purpurea.*
  Stems tubercled on their basal parts, wrinkled and punctate on their middle and upper parts . . . . . (3) *tabularis.*

Key to imperfectly known Species based on Characters in the Male Plants.

Stems compressed . . . . . (7) *anceps.*
Stems terete:
  Outer perianth-segments hyaline-membranous . . . . (8) *filiformis.*
  Outer perianth-segments cartilaginous:
    Stems finely tubercled . . . . . (9) *decipiens.*
    Stems almost smooth . . . . . (10) *Mahoni.*

1. H. digitata, *Pillans*, comb. nov.: **Restio digitatus,** *Thunb., Diss.*, 18 (1788)!; *in Usteri, Delect.*, 53 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 170 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 727 (1806); *Pers., Synops. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. 1,

p. 335 (1811); ed. *Schultes*, 88 (1823); *Spreng., Syst. Veg.*, i, 186 (1825); *Nees in Linnaea*, v, 638 (1830), excl. var. β; *op. cit.*, vii, 615 (1832), excl. var. β et syn.; *Kunth, Enum.*, iii, 410 (1841), quoad var. α; *Steud., Synops.*, ii, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 228 (1865), excl. var. β; *Thunb. Herb. ex Mast., op. cit.*, xiv, 417, 418 (1875); *Mast. in DC. Monog. Phan.*, i, 369 (1878); *in Fl. Cap.*, vii, 132 (1897): **H. Eckloniana,** *Nees ex Drège in Linnaea*, xx, 240 (1847)!, nomen; *Mast. in Journ. Linn. Soc.*, x, 263, t. 7, fig. A (1868)!; *in DC. Monog. Phan.*, i, 369; *Durand et Schinz, Consp. Fl Afr.*, v, 521 (1895); *Mast. in Fl. Cap.*, vii, 132: **Restio paniculatus,** *Linn. Herb. ex Mast. in Journ. Linn. Soc.*, xxi, 590 (1885)!: **Calorophus digitatus,** *O. Kuntze, Revisio Gen. Pl.*, pars ii, p. 747 (1891)!: **H. incerta,** *Mast. in Fl. Cap.*, vii, 133 (1897)!.

Stems caespitose, erect, sparingly or much branched, slender, terete, partly fistular, finely wrinkled and punctate, striate on their lower parts, 2–4 dm. high; sheaths tightly convolute, oblong, obtuse or acute, mucronate, coriaceous, about 1 cm. long; male spikelets 2–5, in lax, spicate cymes, at first erect, subsequently spreading or cernuous, at first lanceolate, becoming oblong-lanceolate or oblong, many-flowered, 0·5–1·5 cm. long; spathes sheath-like, deciduous, striate, mostly 6–8 mm. long; bracts erect-spreading, not imbricate, concave within, ovate, obtuse, cartilaginous, straw-coloured, 3–3·5 mm. long; perianth sessile, rotundate, 2–2·5 mm. long; segments linear, membranous; the outer obtuse, reddish; the lateral slightly carinate; inner segments sometimes obsolete, arising from a swollen receptacle, broad-based, acute, hyaline, $\frac{1}{2}$–$\frac{3}{4}$ as long as the outer; female spikelets 1–3, in spicate cymes, lanceolate, ovate or oblong, with 1 fertile flower, occasionally with a rudimentary flower within the bract next above, 7–10 mm. long; spathe closely convolute, persistent, oblong, obtuse, mucronate, coriaceous, about 4 mm. long; bracts 1–4, closely imbricate, ovate-oblong, obtuse, mucronate, cartilaginous, 4–5 mm. long; perianth composed of 1 whorl of 3 outer segments, sessile oblong, 3–4 mm. long; segments linear, or spathulate-oblong, obtuse, often apiculate, membranous, subequal; ovary cylindric; styles 2, shortly united at base; fruit elliptical, tapered at apex, terete, smooth, chestnut-brown when ripe.

South Africa: without precise locality, *Thunberg*, ♂, *Masson*, ♂, *Thom*, 632, ♂ and ♀, 1031, ♂, *Boivin*, 507, ♂, *Sieber*, 228, ♂, *Hooker*, ♀.

Cape Province—Cape Div.: "False Bay," *Robertson*, ♂; "Simon's Bay," *Alexander*, ♂, *Admiral Grey*, ♂; Simon's Town, *Ecklon*, 997, ♂; above Miller's Point, *Wolley-Dod*, 2289, ♂; near Smitswinkel Bay, *Wolley-Dod*, 2543, ♀, 2670, ♂; Klaver Valley, *Moss*, 7865, ♂; Muizenberg, *Wilms*, 3791, ♂; Tokai Flats, *Guthrie*, 1089, ♂, *Pillans*, 3387, ♂, 3388, ♀; Steenberg Rocks, *Wolley-Dod*, 1268, ♂, 2587, ♀.—Stellenbosch Div.: Hottentots Holland, *Zeyher*, ♂ and ♀; Sir Lowry's Pass, *Burchell*, 8267, ♂, *Schlechter*

4825, ♂ and ♀; Gordon's Bay, *Bolus*, 9815, ♀, 9816, ♂.—Caledon Div.: Palmiet River Mts., *Pappe*, ♂ and ♀; Houwhoek, *Zeyher*, 4348, ♂ and ♀, *MacOwan in Herb. Austr.-Afr.*, 1666, ♂, *Schlechter*, 7363, ♀; mountains near Grietje's Gat, *Ecklon and Zeyher*, ♂; Donkerhoek Mts., *Burchell*, 7989, ♂; mountains of Baviaans Kloof, *Burchell*, 7844, ♂; mountains between Villiersdorp and French Hoek, *Bolus*, 7484, ♂.—Bredasdorp Div.: Koude River, *Schlechter*, 10459, ♂, 10460, ♀.

2. H. purpurea, *Pillans*, sp. nov.; culmis caespitosis erectis teretibus rugulosis infra medium ramosis; vaginis arcte convolutis oblongo-lanceolatis acutis subulato-mucronatis coriaceis purpureis; spiculis masculis 2–4 erecto patentibus in spicatam cymam singulis rotundatis vel orbicularis multifloris; spathis vaginiformibus deciduis; bracteis erecto-patentibus oblongo-ovatis vel oblanceolatis obtusis; floribus sessilibus; perianthio imperfecto vel nullo; segmentis exterioribus lateralibus linearibus vel filiformibus cartilagineis purpureis; spiculis femineis in apice ramulorum plerumque solitariis interdum 2 approximatis oblanceolatis teretibus purpureis 1-floris; spatha vaginiformi persistente; bracteis arcte convolutis oblongis obtusis vel subacutis subulato-mucronatis coriaceis; perianthio stipitato; segmentis exterioribus oblongis obtusis cartilagineis; segmentis interioribus minutis; ovario oblongo-lanceolatis; stylis duobus distinctis; fructu duru laevi nigro.

Stems caespitose, erect, moderately branched from near the base upwards, slender, terete, coarsely wrinkled, occasionally obsoletely striate on the lower parts, somewhat silvery-iridescent, 5–7 dm. high, 1–1·5 mm. in diameter at the middle; sheaths tightly convolute, oblong-lanceolate, acute, subulate-mucronate, coriaceous, dorsally rugose and striate, purplish, mostly 1·2–2 cm. long; male spikelets 2–4, in lax spicate cymes, at first erect, ovate, eventually erect-spreading or spreading, rotundate or orbicular, several- to many-flowered, reddish, 5–7 mm. long; spathes erect, sheath-like, smooth, about 1 cm. long, deciduous; bracts erect-spreading; the lower oblong-ovate to oblong-lanceolate, rounded and apiculate at the apex, cartilaginous, smooth, reddish, 4–6 mm. long; the upper oblanceolate or linear-oblanceolate, rounded and muticous at the apex, about 4 mm. long; perianth sessile, incomplete in the lower flowers absent from the upper; the two outer lateral segments when present being the most developed, erect-spreading, linear and dorsally carinate or filiform, softly cartilaginous, purplish, 1·5–2 mm. long; the other segments are represented by minute, soft, and pale scales which are not easily detected; the receptacle is enlarged, succulent, and pale; stamens 3; filaments filiform, pale, 1·25–2 mm. long; anthers linear-oblong, subacute at both ends; female spikelets solitary or 2 in a spicate cyme, oblanceolate, terete, tapered towards the base, 1-flowered, 1–1·4 cm. long; spathe sheath-like, persistent;

bracts about 4, tightly convolute, oblong, rounded or subacute at apex, coriaceous, ferruginous, purplish at the margins, 1–1·5 cm. long; perianth upon a stout, fleshy, and obscurely 6-lobed stipe, composed of 3 outer developed segments and 3 inner scale-like segments; the outer tightly embracing the ovary, oblong, dorsally rounded, rounded at the apex, cartilaginous, ferruginous, bright purple on the upper third, equal, 5–6 mm. long; ovary oblong-elliptical, narrowed at the apex, chestnut-brown; styles 2, free, deciduous; fruit oblong, tapered in its apical portion, terete, smooth, black, about 5 mm. long.

South Africa: Cape Province—Riversdale Div.: north side of Mozambique Kop, above Garcia's Pass, *Muir*, 3124, ♂.—Mossel Bay Div.: Mossel Bay, *Moran in Bolus Herb.*, 15603, ♂.—Ladismith Div.: near Ladismith, *Marloth*, 3162, ♂.—Uniondale Div.: hills near Avontuur, *Fourcade*, 2083, ♂, 2898, ♂ and ♀ (type).—Willowmore Div.: Aasvogelberg, *Andreae*, 980*b*, ♀, 981*b*, ♂.

3. H. tabularis, *Pillans*, sp. nov.; culmis caespitosis decumbentibus ramosis gracilibus teretibus, infra medium tuberculatis, in partes superiores rugulosis; vaginis oblongis acutis aristatis ferrugineis flavo-maculosis ad margines superiores membranaceis; spiculis femineis solitariis interdum 2 vel 3 approximatis lineari-oblongis teretibus infra medium attenuatis ferrugineis 1-floris; spatha vaginiformi persistente; bracteis sterilibus arcte convolutis oblongo-lanceolatis acutis mucronatis cartilagineis marginibus membranaceis; bractea fertili simili sed breviore; perianthio stipitato oblongo; segmentis exterioribus arcte convolutis oblongis cartilagineis apice obtusis paulo emarginatis; segmentis interioribus orbicularibus cartilagineis exterioribus parum brevioribus; ovario oblongo parum compresso; stylis duobus partibus inferioribus connatis.

Stems caespitose, decumbent, much branched, slender, terete, ferruginous and tubercled on their lower parts, wrinkled and punctate on their upper, 5–8 dm. long, 1·5–2 mm. in diameter shortly above the base; sheaths on the lower parts loosely convolute, oblong, subacute or obtuse, slender-aristate, coriaceous, membranous at the upper margins, smooth externally or occasionally sparsely tubercled, 2–2·5 cm. long; sheaths on the branchlets closely convolute except at the ramifications, oblong, acute, aristate, coriaceous, membranous at the upper margins, reddish, yellow-spotted, mostly 8–10 mm. long; female spikelets solitary or occasionally 2 or 3, adjacent, in spicate cymes, linear-oblong, terete, much tapered in their lower parts, bifid at apex, ferruginous, 1–1·5 cm. long; spathe closely convolute, oblong-lanceolate, acute, aristate, coriaceous, with narrow, membranous margins, yellow-spotted, 7–8 mm. long without the awn; sterile bracts about 6, closely convolute, oblong-lanceolate, acute, mucronate, cartilaginous, membranous at the margins, 5–8 mm. long without the

mucro; fertile bract like the sterile but slightly shorter; perianth on a stout stipe, oblong, terete, 3 mm. long; outer segments tightly convolute, oblong, rounded and somewhat emarginate at the apex, cartilaginous; inner segments orbicular, cartilaginous, slightly shorter than the outer; ovary oblong, somewhat compressed, about 2 mm. long; styles 2, united about a third of their length from the base upwards.

South Africa: Cape Province—Cape Div.: on ledges facing south, near head of Echo Valley, Table Mt., *Pillans*, 4143, ♀.

4. H. diffusa, *Mast. in Fl. Cap.*, vii, 132 (1897)!: **H. aspera,** *Mast. in Journ. Linn. Soc.*, x, 264 (1868)!, partim; *in DC. Monog. Phan.*, i, 371 (1878)!, partim.

Stems caespitose, erect, moderately branched, occasionally simple, slender, terete, densely tubercled, 1·5–4 dm. high; branches filiform; sheaths closely convolute except at the ramifications, linear-oblong or lanceolate, acute or acuminate, with a slender awn or mucro, cartilaginous, dorsally tubercled, ferruginous, white-membranous at the apex and upper margins, 5–10 mm. long; male spikelets in lax, racemose cymes, 1 or 2 at each node, oblong or narrowly cuneate, 1–4-flowered, 4–7 mm. long; spathes sheath-like but smaller; bracts about as many as the flowers, often separated on the rhachilla by half their length, linear or oblong-lanceolate, acute or acuminate, mucronate or aristate, cartilaginous, pale-membranous at the margins, 4–5 mm. long; perianth subsessile, oblong, trigonous, 2–3·5 mm. long; outer segments linear, acute, cartilaginous; the inner oblanceolate, acute, hyaline-membranous; female spikelets terminal, solitary, linear, much tapered in the lower part, terete, 1-flowered, 7–10 mm. long; spathe sheath-like, tightly embracing and, without its awn, about equalling the spikelet; bracts about 4, closely convolute, lanceolate, acuminate, slender-aristate or mucronate, cartilaginous, pale-membranous at the margins, 4–5 mm. long without the awn; perianth stipitate, cylindric, 2–3 mm. long; segments closely convolute; the outer ovate-oblong, obtuse, cartilaginous, dorsally rounded, glabrous, pale, becoming reddish in their upper parts; the inner orbicular or rotundate, membranous, pale, becoming cartilaginous and ferruginous in their upper parts, distinctly shorter than the outer; ovary sessile, oblong, terete, red, pale at base, surmounted by a hard, pale cap; styles 2, adjacent, short, very slender.

South Africa: Cape Province—Cape Div.: upper plateau on Table Mt., *Pillans*, 4897, ♂ and ♀.—Caledon Div.: mountains at Houwhoek, *Burchell*, 8065, ♂.—Paarl Div.: French Hoek, *Schlechter*, 9341, ♂, 9342, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 10 partly, ♂ and ♀.

5. H. laxiflora, *Nees in Linnaea*, v, 663 (1830)!; *Kunth, Enum.*, iii,

451 (1841); *Drège in Linnaea*, xx, 240 (1847), nomen; *Steud., Synops.*, ii, 265 (1855); *Mast. in Journ. Linn. Soc.*, x, 263 (1868); *in DC. Monog. Phan.*, i, 369 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895); *Mast. in Fl. Cap.*, vii, 133 (1897): **Calorophus laxiflorus,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891): **Hypolaena foliosa,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 14 (1900) !.

Stems caespitose, erect, sparingly branched, slender, complanate, subterete or terete in their upper parts, finely wrinkled, purple-spotted, 1·5–4 dm. high, 0·5–0·75 mm. in diameter at the middle; lower sheaths tightly convolute, linear-oblong, truncate, cartilaginous, dorsally wrinkled, narrowly membranous at the upper margins, produced at the apex into a foliaceous ligule, 2·5–5 cm. long with the ligule; ligules erect, linear, obtuse to acute, complanate, cartilaginous, purple-spotted, 2–4 cm. long; upper sheaths tightly convolute, linear-oblong, acute, aristate, coriaceous, pale-membranous at the margins, about 1 cm. long; male spikelets numerous, in lax paniculate cymes, linear-oblong, 1–3-flowered, 2–5 mm. long; spathes linear-oblong, acuminate, with a soft mucro, membranous, 3–5 mm. long; bracts equalling the flowers in number, closely embracing and shortly exceeding the flowers, lanceolate, acute, pale-membranous; flowers distinctly spaced on the rhachillae; perianth sessile, cuneate, subterete, 1·75–2 mm. long; outer segments linear-oblong, acute, dorsally convex, cartilaginous, the lateral obscurely keeled; inner segments oblong, obtuse, pale-membranous, equalling the outer; "female spikelets solitary, terminal, oblong; bracts closely imbricate; the lower ovate, awned, pale in the upper part; the upper ovate-rotundate, obtuse, subcartilaginous" (*Nees*); "perianth-segments oblong, 1-nerved, equal; inner smaller, hyaline; ovary oblong, obtuse" (*Masters*); "surmounted by a pale cap" (*Kunth*); "styles 2, free, sometimes dilated at the base into a yellow stylopod" (*Masters*).

South Africa: Cape Province—Cape Div.: in fissures of rock towards the top of Table Mt., *Ecklon*, 843, ♂: in a plantation on the lower plateau of Table Mt., *Wolley-Dod*, 3403, ♂.—Caledon Div.: Houwhoek, *Schlechter*, 7347, ♂.

Ecklon's 843 includes the female plant, which I have not seen.

6. H. graminifolia, *Pillans*, comb. nov.: **Restio graminifolius,** *Kunth, Enum.*, iii, 407 (1841) !; *Drège, Zwei Pfl. Documente*, 84 (1844); *Steud., Synops.*, ii, 254 (1855); *Mast. in Journ. Linn. Soc.*, viii, 239 (1865); *in DC. Monog. Phan.*, i, 265 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 507 (1895); *Mast. in Fl. Cap.*, vii, 77 (1897).

Stems caespitose, tangled, decumbent, moderately branched, filiform, much compressed, slightly winged at the angles, purple-spotted, 2–4 dm. high; sheaths closely convolute, linear-oblong, striate, purple-spotted,

cartilaginous, 0·5–1·5 cm. long, produced into a linear-oblong, obtuse, leaf-like limb, 0·5–1·5 cm. long; male spikelets 2–4, in lax spicate or panicled cymes, rarely solitary, ovate or oblong-ovate, many-flowered, 4–5 mm. long; bracts lanceolate, acute, mucronulate or mucronate, cartilaginous, broadly membranous at the margins, 3–3·5 mm. long; empty bracts absent; perianth shortly stipitate, oblong or narrowly cuneate, compressed, 2–2·25 mm. long; outer segments linear-lanceolate, acute, cartilaginous; the lateral navicular, glabrous; inner segments linear-oblong, obtuse, membranous, pale, distinctly shorter than the outer; female spikelets solitary, on rather long axillary peduncles, oblong, tapered at base, 1-flowered, terete, 6–8 mm. long; empty bracts about 4, closely convolute, linear-lanceolate, mucronate, cartilaginous, 5 mm. long; perianth on a short, stout stipe, oblong, terete, 4 mm. long; segments linear-lanceolate, acute, cartilaginous, with pale-membranous margins; the inner distinctly shorter than the outer; ovary on a swollen discoid stipe, oblong, obscurely quadrate, hardened and irregularly and obsoletely tubercled at the apex, 1-celled; styles 2, short, very slender.

South Africa : without precise locality, *Verreaux*, ♂.

Cape Province—Paarl Div.: mountains at French Hoek, *Drège*, 2021, ♂ and ♀, *Schlechter*, 9255, ♂ and ♀.

Imperfectly known Species.

7. H. anceps, *Mast. in Journ. Linn. Soc.*, x, 267 (1868)!; *in DC. Monog. Phan.*, i, 373 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 521 (1895); *Mast. in Fl. Cap.*, vii, 131 (1897): **Calorophus anceps,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, p. 747 (1891).

Stems erect, filiform, compressed, narrowly winged, mottled yellow and purple, sparingly branched, 2·5–3 dm. high, 0·75 mm. in diameter at the middle; sheaths closely convolute, lanceolate, acute, foliaceo-mucronate at the apex, with a perpendicular dorsal ridge, coriaceous, broadly brown-membranous at the margins, 6–10 mm. long; male spikelets 1–3 in lax spicate cymes, oblong, 1- or 2-flowered, 5–6 mm. long; spathes sheath-like; perianth stipitate, oblong, about 4 mm. long; segments oblong-lanceolate, acute, cartilaginous, glabrous; the outer lateral navicular, carinate; the inner shorter; anthers linear-oblong, apiculate.

South Africa : Cape Province—Riversdale Div.: near the summit of the Kampsche Berg, *Burchell*, 7080 partly, ♂.—George Div.: Post Berg, near George, *Burchell*, 5896 partly, ♂.

This is Burchell's *Restio anceps* in manuscript.

8. H. filiformis, *Mast. in Journ. Linn. Soc.*, x, 267 (1868)!; *in DC. Monog. Phan.*, i, 372 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 522

(1895) ; *Mast. in Fl. Cap.*, vii, 134 (1897) : **Calorophus filiformis,** *O. Kuntze, Rev. Gen. Pl.*, pars ii, 747 (1891).

Stems caespitose, erect, filiform, terete, wrinkled or obsoletely tubercled, yellow-speckled, sparingly branched, rarely simple, 2–4 dm. high ; sheaths closely convolute, oblong or linear-oblong, tapered in the upper part to an acute or obtuse apex, aristate, cartilaginous, red-brown, yellow-speckled, 1–1·5 cm. long ; male spikelets 1–8 in laxly spicate or panicled cymes, ovate or elliptic, many-flowered, 6–12 mm. long ; spathe sheath-like, reaching to about the middle of the spikelet ; bracts loosely imbricate or erect-spreading, ovate, acute, mucronate, cartilaginous, light brown, 3–4 mm. long ; perianth sessile, ovate, 1·5–2 mm. long ; segments oblong, hyaline-membranous : the outer lateral navicular, acute, with pale papilla-like hairs on the carina ; inner segments slightly exceeding the outer in length.

South Africa : without precise locality, *Thom*, ♂.

Cape Province—Caledon Div. : mountains at Houwhoek, *Zeyher*, 4349 partly, ♂, *MacOwan in Bolus Herb.*, 15884, ♂ ; Zwartberg, *Guthrie in Bolus Herb.*, 16009, ♂, 17216, ♂.

9. H. decipiens, *N. E. Brown in Fl. Cap.*, vii, 755 (1900) !.

Stems erect, moderately branched, terete, slender, finely tubercled, 3–5 dm. high ; sheaths closely convolute, oblong, acute, mucronate, coriaceous, externally rugulose or striate, broadly pale-membranous at the upper margins, 4–6 mm. long ; male spikelets in narrow spicate or paniculate cymes, lanceolate, 1- or 2-flowered, 5–6 mm. long ; spathes sheath-like, closely embracing the spikelets, 5–6 mm. long ; bracts closely convolute, oblong, acute, cartilaginous, pale-membranous at the upper margins, 3·5–4 mm. long ; perianth subsessile, narrowly cuneate, 4–5 mm. long ; outer segments linear-lanceolate, acute, dorsally convex, cartilaginous, light brown ; inner segments lanceolate, acute, hyaline-membranous, much shorter than the outer.

South Africa : Cape Province—Swellendam Div. : Zuurbraak, *Galpin*, 4792, ♂.

10. H. Mahoni, *N. E. Brown in Fl. Trop. Afr.*, vii, 265 (1901) !.

Stems erect, moderately branched, wiry, terete, almost smooth, somewhat punctate, 3–5 dm. high, 1·25–1·5 mm. in diameter at the middle ; sheaths tightly convolute, oblong-lanceolate, obtuse, shortly and stoutly mucronate, coriaceous, externally punctate, mostly 1–1·5 cm. long ; male spikelets 1–3, in lax spicate cymes, broadly cuneate or ovate, laxly 3–5-flowered, 6–8 mm. long ; spathes loosely embracing the spikelets, ovate-oblong, sheath-like, 4–5 mm. long ; bracts loosely clasping the flowers, strongly decurrent on the rhachilla, oblong or oblong-lanceolate, acute, cartilaginous, ferruginous, 3·5–5 mm. long ; perianth stipitate, oblong or

cuneate, 3·75–4 mm. long; outer segments linear, acute, cartilaginous, glabrous, equal; the lateral somewhat keeled; inner segments lanceolate, acute, submembranous, equalling the outer; anthers oblong, obtuse at both ends, muticous.

British Central Africa—NYASALAND: Zomba, *Mahon*, ♂.

In the Kew Herbarium there are sterile specimens (*McClounie*, 28) collected on Mount Mlanji, Nyasaland, which may belong to this species.

VIII, HYPODISCUS, *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 450 (1836); *Kunth, Enum.*, iii, 481 (1841); *Meisner, Gen. Pl.*, 409 (1842); *Steud., Synops. Pl.*, ii, 265 (1855); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 414 (1868); *Mast. in Journ. Linn. Soc.*, x, 252 (1868); *in DC. Monog. Phan.*, i, 379, tab. iv, figs. 8–15, tab. v, figs. 17*a*, 17*b* (1878); *Benth. et Hook., Gen. Pl.*, iii, 1035 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 10 (1888); *Mast. in Fl. Cap.*, vii, 135 (1897): **Lepidanthus,** *Nees in Linnaea*, v, 665 (1830); *Endl., Gen.*, 121 (1836); *Harv., Gen. S. Afr. Pl.*, 356 (1838); *Endl., Gen.*, Suppl. 2, p. 11 (1842): **Leucoploeus,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 450; *Kunth, Enum.*, iii, 481; *Steud., Synops.*, ii, 266; *Meisner, Gen.*, 409: **Willdenowia b. Hypodiscus et c. Leucoploeus,** *Endl., Gen.*, 121: **Boeckhia,** *Kunth, Enum.*, iii, 448; *Endl., Gen.*, Suppl. 2, p. 10; *Meisner, Gen.*, 409; *Steud., Synops.*, ii, 263.

Flowers dioecious. Male spikelets few or many in spicate or panicled cymes, occasionally solitary and terminal, compact or lax, each usually accompanied by a rather conspicuous deciduous spathe, many-flowered. Perianth usually much compressed; segments 6 or the inner series absent, the outer lateral generally navicular and conduplicate. Anthers linear-oblong, apiculate. Rudimentary ovary 2-styled. Female spikelets few or occasionally many in spicate or panicled cymes, rarely solitary, compact, each subtended by a rather conspicuous, usually persistent spathe, with 1 flower (occupying a terminal position), with many empty bracts below the flower. Perianth sessile or stipitate, terete; segments 6 or fewer, or absent. Staminodes minute. Ovary usually stipitate, oblong, terete, often surmounted by a toothed or lobed disc, 1-celled; styles 2, deciduous, free or shortly connate at base. Fruit stipitate or sessile, barrel-shaped or rotundate, smooth, tessellate or tubercled on the sides or at the apex, indehiscent.

Flowering stems tufted or closely set along creeping rhizomes, erect, terete or compressed, rarely striate, simple. Leaf-sheaths persistent, often few, occasionally absent from the upper parts of the stems, closely convolute. Barren stems usually few or absent.

The genus is endemic.

Key based on Characters in the Female Plants.

Stems more or less striate or sulcate :
- Stems compressed . . . . . (8) *Willdenowia.*
- Stems terete :
  - Perianth absent . . . . . (5) *argenteus.*
  - Perianth present :
    - Spikelets 1–1·5 cm. long ; ovary entirely smooth or rugose on its upper parts, surmounted by a tubercled cone or tuft of terete lobes ; styles united half their length . . . . . (6) *Neesii.*
    - Spikelets 1·5–1·8 cm. long ; ovary wrinkled, surmounted by a smooth, horny disc ; styles free . . . . . (7) *striatus.*

Stems neither striate nor sulcate :
- Ovary surmounted by a smooth, horny disc . . . . . (1) *aristatus.*
- Ovary surmounted by a toothed or lobed disc :
  - Lower bracts mucronate or mucronulate, the upper aristate . . (3) *binatus.*
  - Lower and upper bracts aristate :
    - Ovary surmounted by a disc composed of 1–3 series of teeth ; stems without leaf-sheaths above the base or occasionally with one sheath . (2) *albo-aristatus.*
    - Ovary surmounted by a disc composed of linear, fleshy lobes ; stems with 2 or 3 leaf-sheaths above the base . . . . . (4) *synchroolepis.*

1. H. aristatus, *Nees in Lindl. Nat. Syst.*, ed. 2, p. 450 (1836) ; *Kunth, Enum.*, iii, 481 (1841) ; *Drège in Linnaea*, xx, 240 (1847), nomen ; *Mast. in Journ. Linn. Soc.*, x, 252 (1868) ; *in DC. Monog. Phan.*, i, 380 (1878) ; *Durand et Schinz, Consp. Fl. Afr.* v, 523 (1895) ; *Mast. in Fl. Cap.*, vii, 137 (1897) : **Restio aristatus,** *Thunb., Diss.*, 10, fig. 4 (1788) ! ; *in Usteri, Delect.*, i, 44, t. 2, fig. 4 (1790) ; *ejusd. Prodr. Cap.*, 15 (1794) ; *Poir. in Lam., Encycl. Meth.*, vi, 174 (1804) ; *Willd., Sp. Pl.*, iv, pars 2, 719 (1806) ; *Pers., Syn. Pl.*, ii, 606 (1807) ; *Thunb., Fl. Cap.*, ed. 1, p. 318 (1811) ; ed. *Schultes*, 83 (1823) ; *Spreng., Syst. Veg.*, i, 184 (1825), excl. syn. ; *Nees in Linnaea*, v, 636 (1830) ; *Kunth, Enum.*, iii, 383, excl. var. β ; *Drège, Zwei Pfl. Documente*, 76, 82, 88 (1841) ; *Drège in Linnaea*, xx, 240, nomen ; *Steud., Synops.*, ii, 249 (1855) ; *Mast. in Journ. Linn. Soc.*, viii, 226 (1865) ; *Thunb. Herb. ex Mast., op. cit.*, xiv, 415, No. 2 (1875) : **H. aristatus,** *Nees*, var. **expallens,** *Nees ex Drège in Linnaea*, xx, 240 (1847) !, nomen : **H. aristatus,** *Nees*, var. **bicolor,** *Mast. in Journ. Linn. Soc.*, x, 253 (1868) ! ; *in DC. Monog. Phan.*, i, 381 ; *Durand et Schinz, Consp. Fl. Afr.*, v, 523 ; *Mast. in Fl. Cap.*, vii, 138.

Stems caespitose, erect, simple, terete, finely wrinkled and pitted, wiry, solid or somewhat fistular, 3–8 dm. high, 1–2 mm. in diameter at middle ; sheaths closely convolute in their lower parts, loose in their upper, linear-oblong, obtuse or subacute, subulate-mucronate, occasionally with a large foliaceous mucro, coriaceous, cartilaginous at the margins, more or less nervose-striate, purplish, yellow at the margins, mostly 3–4 cm. long ; male

inflorescence spicate or paniculate-cymose, oblong or linear-oblong, usually containing 4–6 adjacent spikelets; spathes sheath-like, persistent, loosely embracing the spikelets, 2–3 cm. long; spikelets erect, conical or subglobose, 1·5–2 cm. long; bracts loosely imbricate, oblong, acuminate, mucronate or shortly aristate, cartilaginous, minutely rugulose, purple-brown, pale or yellowish at the margins, 8–12 mm. long; perianth sessile, oblanceolate or cuneate, much compressed, 6·5–8 mm. long; segments membranous; the outer lateral navicular, linear-oblong, acute, often apiculate, shortly villous on the carina, reddish; the anterior narrowly spathulate-oblong, acute, apiculate, reddish; inner segments oblanceolate, subacute, hyaline, shorter than the outer; female spikelets 1–4, in spicate or rarely in paniculate cymes, adjacent, lanceolate to oblong, 1-flowered, 2–3 cm. long; spathes persistent, sheath-like, each about as long as its subtended spikelet; bracts many, loosely imbricate, lanceolate, acuminate, mucronate, cartilaginous, minutely rugulose, purplish, pale or yellow at the margins, 1·5–2·5 cm. long; perianth shortly stipitate, cylindric, 6–8 mm. long, elongating with the development of fruit up to 1·5 cm.; segments lanceolate, acute, apiculate, membranous, externally scabrid, pale, the outer exceeding the inner, becoming oblanceolate and purplish during the fruiting period; ovary stipitate, oblong, with a horny ring round its base and a rounded, horny apex; styles deciduous, cohering at base; fruit on a short, fluted stipe, barrel-shaped, flattened at base and summit, with an encircling furrow or constriction shortly above its base, smooth, purple-brown, 7–8 mm. long.

South Africa: without precise locality, *Banks*, ♂, *Thunberg*, ♂, *Drège*, 21, ♂, *Sieber*, 113, ♂, 118, ♂, *Ludwig*, ♂, *Leibold*, 39, ♂.

Cape Province—Cape Div.: Camp's Bay, *Burchell*, 339, ♀; Table Mt., *Alexander*, ♂, *Pappe in Herb. Mus. Austr.-Afr.*, 13025, ♂ and ♀, *Bolus*, 4106, ♂, *Marloth*, 1566, ♂; Retreat Flats, *Wolley-Dod*, 2576, ♀; Silver Mine Valley, *Pillans*, 3414, ♂; mountains near Simon's Town, *Pappe in Herb. Mus. Austr.-Afr.*, 13026, ♂ and ♀; Klaver Valley, *Pillans*, 4180, ♂ and ♀; Cape Flats, *Alexander*, ♂; "False Bay," *Robertson*, ♀.—Stellenbosch Div.: mountains at Stellenbosch, *Berg*, ♂; Sir Lowry's Pass, *Guthrie in Bolus Herb.*, 16618, ♂ and ♀.—Paarl Div.: Bain's Kloof, *Bolus*, 4106, ♀.—Piquetberg Div.: on the Piquetberg, *Drège*, 2513, ♂.—Clanwilliam Div.: Pretorius Kloof, between Piquiniers Kloof and Olifants River, *Drège*, 2509, ♂ and ♀; Olifants River Mts., *Zeyher*, ♂ and ♀.—Tulbagh Div.: Tulbagh Kloof, *MacOwan*, 1680, ♂ and ♀, 1681, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 20, ♂, 140, ♀ 1656, ♀, *Bolus*, 15214, ♀; mountains above Worcester, *Rehmann*, 2555, ♂ and ♀; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17667, ♂; Onklaarberg, *Stokoe*, 1119, ♀.—Caledon Div.: mountains near Grietje's Gat, *Zeyher*, ♂ and ♀; Steenbras, *Rogers*, 11067, ♀; Houwhoek, *Zeyher*, 4332, ♂ and ♀, *Schlechter*, 7775, ♀, 7776, ♂; Zwartberg, *Pappe in*

Herb. Mus. Austr.-Afr., 12825, ♀; Donkerhoek Mt., *Burchell*, 7963, ♂; mountains of Baviaans Kloof, Genadendal, *Burchell*, 7594, ♂ and ♀; between Villiersdorp and French Hoek, *Bolus*, 7487, ♀.—SWELLENDAM DIV.: mountain peak near Swellendam, *Burchell*, 7373, ♀.—RIVERSDALE DIV.: Kampsche Berg, *Burchell*, 7057, ♀; Garcia's Pass, *Bolus*, 11408, ♀, *Galpin*, 4187, ♀, *Marloth*, 3644, ♀; Riversdale, *Rust*, 408*a*; Corenti River, *Muir*, 5401, ♀; Phisantefontein, *Muir*, 3201, ♂, 3202, ♀.—GEORGE DIV.: lower part of Post Berg, near George, *Burchell*, 6027, ♂ and ♀; mountains near George, *Drège*, 3941, ♂ and ♀, *Rogers*, 4318, ♀, 4369, ♂.—UNIONDALE DIV.: Prince Alfred's Pass, *Fourcade*, 2064*b*, ♂.—HUMANSDORP DIV.: flats at Oudebosch, *Fourcade*, 2299, ♂ and ♀.

This species is in several herbaria with the manuscript name "*Hypodiscus bicolor*" of Nees.

Var. β, protractus (*Pillans*): **H. protractus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 17 (1900)!. Stems buff-coloured when dry; sheaths and spathes yellow; bracts cream. These colourings being probably due to albinism.

South Africa: Cape Province—STELLENBOSCH DIV.: Sir Lowry's Pass, *Schlechter*, 7794, ♂, 7795, ♀.

2. H. albo-aristatus, *Mast. in Journ. Linn. Soc.*, x, 257 (1868)!; [*Nees in Linnaea*, xx, 240 (1847), absque descript.]; *Mast. in DC. Monog. Phan.*, i, 382 (1878); *in Journ. Linn. Soc.*, xxi, 591, No. 21 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895); *Mast. in Fl. Cap.*, vii, 140 (1897): **Restio albo-aristatus,** *Nees in Linnaea*, v, 635 (1830)!; *Kunth, Enum.*, iii, 407 (1841); *Steud., Synops.*, ii, 249 (1855): **Boeckhia laevigata,** *Kunth, Enum.*, iii, 450!; *Drège, Zwei Pfl. Documente*, 76 (1844); *Steud., Synops.*, ii, 264: **H. duplicatus,** *Hochst. in Flora*, 1845, p. 338, excl. syn. *Steud.*!; *Steud., Synops.*, ii, 265, excl. syn.: **H. rugosus,** *Mast. in Journ. Linn. Soc.*, x, 255!; *in DC. Monog. Phan.*, i, 386; *Durand et Schinz, Consp. Fl. Afr.*, v, 523; *Mast. in Fl. Cap.*, vii, 140: **Restio aristatus,** *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 415, No. 3 (1875)!: **H. Zeyheri,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 17 (1900)!: **H. tristachyus,** *Mast., loc. cit.*!: **H. capitatus,** *Mast. in Journ. Bot.*, xxxix, 402 (1901)!.

Stems caespitose, erect, simple, wiry, terete or somewhat flattened in parts, occasionally twisted, more or less fistular, smooth or rugulose, yellow-speckled, 3–7 dm. high, about 1 mm. in diameter at middle; sheaths numerous at the base of the stem, none or occasionally one above the base, rather loosely convolute or the upper tightly convolute, linear-oblong, subacute or obtuse, slender-aristate, coriaceous, thinner at the margins, nervose-striate, pale or the upper brown, mostly 3–5 cm. long; male spikelets 1–8, in spicate or less often paniculed cymes, adjacent, ovate to subrotund, 7–12 mm. long; spathes subpersistent, oblong-lanceolate, acute,

aristate, expanded, cartilaginous, purple-brown, pale at the margins, mostly 1–2 cm. long with the awn; bracts closely imbricate, ovate-oblong or oblong, acute, aristate, cartilaginous, scabrid on exposed parts, purple, pale at the margins, 5–8 mm. long with the awn; perianth subsessile, oblong, 3·75–5 mm. long; segments lanceolate, acute, membranous, reddish; the outer lateral carinate, glabrous, shortly exceeding the inner; female spikelets 1–8, adjacent in spicate or less often in paniculate cymes, oblong-lanceolate or oblong, 9–14 mm. long; spathes as in the male; bracts about 20, closely imbricate, oblong or oblong-lanceolate, acute, aristate, cartilaginous, dorsally scabrid, purple, pale at margins and apex, 7–10 mm. long with the awn; perianth on a short, stout stipe, 1·5–1·75 mm. long, without evident enlargement with the development of the fruit; segments ovate to deltoid-lanceolate, acute, membranous, fleshy at base; the inner smaller than the outer; ovary oblong, rugose, surmounted by a small fluted or tubercled cap which is encircled by a disc composed of 1–3 series of teeth; styles variously united up to half their length or less often free with the stigmatic surfaces extending to their bases; fruit rotundate or conical, closely studded all over with adpressed tubercles, brown, about 3 mm. long.

South Africa: without precise locality, *Masson*, ♂, *Thunberg*, ♀, *Carmichael*, ♂, *Thom*, 1060, ♂, *Berg*, *Alexander*, ♀.

Cape Province—Cape Div.: Table Mt., *Drège*, 199*a*, ♂; Devil's Peak, *Bolus*, 4447, ♀, *Pillans*, 3413, ♂ and ♀; Orange Kloof, *Schlechter*, 725, ♂, *Wolley-Dod*, 2538, ♂; Constantia, *Zeyher*, ♂; Steenberg, *Wolley-Dod*, 2589, ♀, *Pillans*, 4179, ♂; Hout Bay, *Wolley-Dod*, 2644, ♂, 2645, ♀; Muizenberg, *Pearson*, 220, ♂; Simon's Town Mts., *Ecklon and Zeyher*, ♂; Cape Flats, *Zeyher*, ♂ and ♀.—Stellenbosch Div.: Hottentots Holland Mts., *Ecklon and Zeyher*, ♂ and ♀; Sir Lowry's Pass, *Rogers*, 11035, ♀, *Guthrie in Bolus Herb.*, 16620, ♂.—Paarl Div.: French Hoek, *Schlechter*, ♀; Kraaifontein, *Marloth*, 3190, ♂, 3191, ♀.—Caledon Div.: mountains of Baviaans Kloof, Genadendal, *Burchell*, 7655, ♀; Hemel en Aarde, *Zeyher*, 4333, ♀; between Villiersdorp and French Hoek, *Bolus*, 7488, ♀.—Tulbagh Div.: Great Winterhoek, *Phillips*, 1695, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 15, 1653, ♀.—Ladismith Div.: Seven Weeks Poort, *Marloth*, 3173, ♂.—Prince Albert Div.: Zwartberg Pass, *Bolus*, 11659, ♀, 11660, ♀.—Swellendam Div.: Voorman's Bosch, *Zeyher*, 4336, ♀.—Riversdale Div.: Garcia's Pass, *Bolus*, 11409, ♀; near Riversdale, *Muir*, 2869, ♂.—Laingsburg Div.: Witte Berg, near Matjesfontein, *Marloth*, 3147, ♂ and ♀.—Knysna Div.: the Glebe, *Galpin*, 4818, ♂, 4819, ♀; Concordia Plantation, on coastal plateau, *Keet*, 497, ♂ and ♀.—Humansdorp Div.: Karredouw Pass, *Fourcade*, 1147*a*, ♂.

In several of the older herbaria plants of this species are accompanied

by the following manuscript names given by Nees:—*Restio tristachyus*, *R. sphaerostachyus*, *Hypodiscus rugosus*.

Var. β, Oliverianus (*Pillans*): **H. Oliverianus**, *Mast. in Journ. Linn. Soc.*, x, 254 (1868)!; *in DC. Monog. Phan.*, i, 381 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 137 (1897).

Bracts of the male spikelets with erect-spreading, yellowish awns which are longer than those in the species; bracts of the female spikelets are inclined to spread and are somewhat longer than in the species.

South Africa: Cape Province—PAARL DIV.: French Hoek Mts., *Schlechter*, 9323, ♀.—CALEDON DIV.: Houwhoek, *Burchell*, 8118, ♂ and ♀; Grietje's Gat, *Bolus*, 4222, ♂.

3. H. binatus, *Mast. in Journ. Linn. Soc.*, x, 258 (1868)!; *in DC. Monog. Phan.*, i, 388 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 138 (1897): **Dovea binata,** *Steud., Synops.*, ii, 248 (1855).

Stems caespitose, erect, simple, terete, fistular, smooth, white-speckled, 4–8 dm. high, 1·5 mm. in diameter at middle; sheaths 2 or 3 above those which are imbricate at the base of the stem, closely convolute except in their upper parts, linear-oblong, acute, subulate-mucronate, coriaceous, purple-brown, yellow-speckled, cartilaginous and yellowish at apex and margins, 2·5–3·5 cm. long with the mucro; male inflorescence paniculate-cymose, rarely spicate-cymose, linear-oblong, rather lax, 3–6 cm. long; spathes deciduous, oblong-lanceolate or the upper ovate-lanceolate, acute, mucronate, cartilaginous, nervose, purple-brown, yellowish at margins and apex, 5–18 mm. long; spikelets several or many, rotundate or orbicular, 5–8 mm. long; bracts closely imbricate, the middle and upper having perfect flowers in their axils, oblong, subacute, cartilaginous, dark purple, narrowly membranous and pale at the margins, minutely scabrid on exposed parts, 4–5 mm. long; perianth shortly stipitate, oblong, 3·5–4 mm. long; outer segments lanceolate, acute, cartilaginous, glabrous, purplish; the lateral navicular; inner segments lanceolate, subacute, membranous, pale, slightly shorter than the outer; female inflorescence paniculate- or spicate-cymose, linear or linear-oblong, usually 4–6 cm. long; spathes as in the male, subpersistent; spikelets several or many, linear-lanceolate during the flowering period, becoming oblanceolate, 1–1·3 cm. long; bracts closely imbricate, lanceolate-oblong, acute, cartilaginous, minutely scabrid on exposed parts, purple, pale and membranous at base and margins, 8–10 mm. long; the lower mucronulate or mucronate, the upper aristate; perianth sessile, at first 1–1·5 mm. long, developing with the fruit to 2·5 mm. in length; segments deltoid-lanceolate, acute, imbricate and fleshy in their lower parts, membranous above, pale, unequal; ovary shortly stipitate, oblong, surmounted by a warty disc; styles united upwards for

⅔ of their length, 6–7 mm. long, red, with a pale stigmatic surface; fruit on a stout warty stipe, cylindric or conical, smooth at the sides or with vertical furrows, with a ring of closely set tubercles round its upper edge, topped with a cone formed of tightly packed tubercles, light brown, about 3 mm. long.

South Africa: Cape Province—Caledon Div.: Donkerhoek Mt., *Burchell*, 7958, ♂ and ♀; Houwhoek, *Schlechter*, 7446, ♂, 7770, ♀.—Piquetberg Div.: on the Piquetberg, *Drège*, 2477, ♂, 2478, ♀.—Tulbagh Div.: Tulbagh Kloof, *MacOwan*, 1679, ♂ and ♀.—Worcester Div.: Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17668, ♂ and ♀.—Riversdale Div.: north end of Garcia's Pass, *Muir*, 3180, ♂, 3181, ♀; Phisantefontein, north slopes of Lange Bergen, *Muir*, 3205, ♂, 3206, ♀.

4. H. synchroolepis, *Mast. in Journ. Linn. Soc.*, x, 256, tab. 7, fig. *c* (1868)!; *in DC. Monog. Phan.*, i, 387 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 139 (1897): **Restio synchroolepis,** *Steud., Synops.*, ii, 250 (1855)!.

Stems caespitose, erect, simple, slender, terete, fistular, smooth, white-spotted, about 4 dm. high, scarcely 1 mm. in diameter at middle; sheaths 2 or 3 above the base of the stem, closely convolute or loose in their upper parts, linear-oblong, subacute, subulate-mucronate, coriaceous, nervose, brown, cartilaginous and yellowish at the apex and margins, yellow-speckled, mostly 2–2·5 cm. long; male spikelets several or many, adjacent or separated, in spicate or panicled cymes, rotundate, 6–8 mm. long; spathes sheath-like, persisting during the flowering period, erect-spreading, expanded, the lower 1·5–2·5 cm. long; bracts closely imbricate, oblong-lanceolate, aristate, cartilaginous, scabridous and dark purple on exposed parts, 5–6 mm. long with the pale awn; perianth subsessile, oblong, about 4 mm. long; segments linear-lanceolate, acute, cartilaginous, reddish; the outer lateral navicular, slightly keeled; female spikelets several, in spicate cymes, at first linear-lanceolate, becoming oblong, 8–12 mm. long; spathes sheath-like, oblong-lanceolate, each shortly or much exceeding its subtended spikelet; bracts closely imbricate, oblong-lanceolate, aristate, cartilaginous, scabridous and purple on exposed parts, narrowly pale-membranous at the margins, 6–10 mm. long with the awn; perianth sessile, 1–2 mm. long; segments deltoid to oblong, acute, membranous, unequal; ovary oblong, terete, wrinkled, surmounted by a ring of erect, linear, fleshy lobes and a fluted stylopodium; styles shortly united.

South Africa: Cape Province—Humansdorp Div.: near Kromme River, *Drège*, 17, ♂ and ♀; Gouna Plateau, *Keet*, 972, ♂ and ♀.—Uitenhage Div.: Van Stadensberg, *Ecklon*, 816, ♂, 817, ♂ and ♀, 818, ♂ and ♀, *Zeyher*, 4334, ♂ and ♀.

5. H. argenteus, *Mast. in Journ. Linn. Soc.*, x, 261 (1868)!; *in DC.*

Monog. Phan., i, 383 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895); *Mast. in Fl. Cap.*, vii, 137 (1897): **Restio argenteus,** *Thunb., Diss.*, 14 (1788)!; *in Usteri, Delect.*, i, 49 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 176 (1804); *Willd., Sp. Pl.*, iv, pars 2, p. 722 (1806); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. 1, 326 (1811); ed. *Schultes*, 85 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Nees in Linnaea*, v, 656 (1830); *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 417 (1875): **Leucoploeus argenteus,** *Nees in Lindl. Nat. Syst.*, ed. 2, p. 450 (1836)!: **Willdenowia simplex,** *N. E. Brown in Fl. Cap.*, vii, 756 (1900)!.

Stems caespitose, erect, simple, wiry, more or less sulcate-striate, more so in the lower parts, slightly fistular, 5–9 dm. high, 1·5–2 mm. in diameter at middle; sheaths tightly convolute, oblong, acute or acuminate, with a deciduous, slender awn, coriaceous, with deciduous, membranous margins, often membranous and lacerate at the apex, nervose-striate, red-brown, 2–3 cm. long; male inflorescence paniculate-cymose, oblong or linear-oblong, dense, mostly 4–10 cm. long; spathes caducous, conspicuous, loosely embracing the spikelets, lanceolate, acuminate, aristate, cartilaginous or chartaceous, closely nervose, mostly 3·5–6 cm. long; rhachillae short, bearing 1–several spikelets; spikelets numerous, at first oblong, becoming obovate or rotund, many-flowered, 4–8 mm. long; bracts loosely imbricate, lanceolate, acuminate, mucronate, membranous, pale, about 5 mm. long; perianth sessile, oblong, compressed, 2 mm. long; segments acute, membranous, subequal; the outer lateral lanceolate, carinate, mucronate; the anterior and inner oblong; female spikelets 1–4, adjacent, in linear, spicate cymes, oblong, 1·5–2·5 cm. long; spathes deciduous, similar to those of the male; bracts about 15, closely imbricate, linear-oblong, acuminate, mucronate, cartilaginous, pale or purplish, 1–2 cm. long; flowers solitary in each spikelet; perianth absent, represented by a ring of short, crest-like processes at the base of the ovary; ovary on a short, lobed stipe, without disc or cone on its summit, ovate, smooth; styles deciduous, free, glabrous at base; fruit on a short, lobed stipe, barrel-shaped, smooth or wrinkled and tubercled on its lower parts.

South Africa: without precise locality, *Thunberg*, ♂, *Masson*, ♂, *Drège*, 99, ♂.

Cape Province—Stellenbosch Div.: Sir Lowry's Pass, *Schlechter*, 4822, ♂, 7290, ♀, *Guthrie in Bolus Herb.*, 16619, ♂ and ♀, *Duthie*, 1482, ♂.—Paarl Div.: French Hoek Mts., *Pickstone*, 16, ♂, 30, ♀, 31, ♀, 32, ♀, 40, ♀.—Caledon Div.: Houwhoek, *Burchell*, 8117, ♂, 8129, ♀, *Pappe in Herb. Mus. Austr.-Afr.*, 13024, ♀; Palmiet River, *Ecklon*, 972, ♂ and ♀; mountains of Baviaans Kloof, *Burchell*, 7901, ♂; Genadendal, *Drège*, 1642, ♂, *Pappe in Herb. Mus. Austr.-Afr.*, 12871, ♂; Zwartberg, *Guthrie in Bolus Herb.* 16075, ♂, *Pillans in Bolus Herb.*, 15481, ♂ and ♀; mountains between

Villiersdorp and French Hoek, *Bolus*, 15908, ♂, 15909, ♀.—Tulbagh Div.: Tulbagh Kloof, *MacOwan*, 1682, ♂.—Ceres Div.: mountains at Ceres, *Bolus*, 5294, ♀.—Little Namaqualand: rocky hills by the Hartebeest River, *Zeyher*, 4338, ♂ and ♀.—Riversdale Div.: Kampsche Berg, *Burchell*, 7058, ♂ and ♀; Garcia's Pass, *Bolus*, 11406, ♂, 11407, ♀, *Galpin*, 4817*a*, ♀, 4820, ♂ and ♀; Glen Leith, *Muir*, 3305. ♂ and ♀.—Knysna Div.: hillsides at the Glebe, *Galpin*, 4821, ♂.

This is the *Restio monospermus*, Burchell MSS., as seen by me on his sheets.

6. H. Neesii, *Mast. in Journ. Linn. Soc.*, x, 260 (1868)!; *in DC. Monog. Phan.*, i, 384 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 138 (1897): [**Leucoploeus striatus,** *Nees ex Drège in Linnaea*, xx, 242 (1847)!, nomen]: **H. eximius,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 17 (1900)!.

Stems caespitose, erect, simple, terete, slender, sulcate-striate, occasionally also wrinkled, 3–5 dm. high, 0·5–0·75 mm. in diameter; sheaths tightly convolute, linear-oblong, acute, filiform-aristate, cartilaginous, membranous at apex, reddish, about 2 cm. long; male inflorescence spicate-cymose, narrow, 2–5 cm. long; spathes caducous, chartaceous, resembling the upper sheaths; spikelets usually 3–6, sessile, oblong, densely many-flowered, 5–12 mm. long; spathellae lanceolate, long-acuminate, hyaline, 4–5 mm. long, with a callus-like swelling at the base; bracts erect-spreading, expanded, lanceolate, acuminate, hyaline, 3–10 mm. long; perianth stipitate, oblong-ovate, 2·25–2·5 mm. long; segments ovate, apiculate, cartilaginous; the outer lateral navicular; the inner distinctly exceeding the outer; female spikelets 1–3, approximate in spicate cymes, linear-oblong to ovate, 1–1·5 cm. long; spathes persistent, linear-lanceolate, with a long, slender, hyaline awn, exceeding the spikelets; bracts at first closely imbricate, becoming loose, about 10, lanceolate-oblong, acuminate, slender-aristate, cartilaginous, reddish, pale at apex, about 1·2 cm. long; perianth sessile, oblong, 2–3·5 mm. long; segments oblong, acute, often apiculate, membranous, subequal; ovary sessile, oblong, entirely smooth or rugose on its upper parts, surmounted by a tubercled cone or tuft of terete lobes; styles united throughout about half their length, slender; fruit sessile, barrel-shaped.

South Africa: without precise locality, *Drège*, 9614, ♀.

Cape Province—Clanwilliam Div.: Pretoris Kloof, between Piquiniers Kloof and Olifants River, *Drège*, 2492, ♂, 2493, ♀; Brakfontein, Olifants River Valley, *Ecklon and Zeyher*, ♂ and ♀; Ezelsbank, *Schlechter*, 8820, ♂, 8821, ♀.—Bredasdorp Div.: hills near Rietfontein Poort, *Schlechter*, 9682, ♀.—Laingsburg Div.: Witteberg, near Matjesfontein, *Marloth*, 3140, ♂, *Compton*, 2752, ♂ and ♀.

7. H. striatus, *Mast. in Journ. Linn. Soc.*, x, 258 (1868)!; *in DC. Monog. Phan.*, i, 385 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 139 (1897): **Boeckhia striata,** *Kunth, Enum.*, iii, 449 (1841)!; *Drège, Zwei Pfl. Documente*, 64, 69, 70 (1844); *Drège in Linnaea*, xx, 242 (1847); *Steud., Synops.*, ii, 263 (1855): [**H. gracilis,** *Nees ex Drège in Linnaea*, xx, 242, nomen!]: **H. gracilis,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 16 (1900)!: **H. rigidus,** *Mast., op. cit.*, p. 18!.

Stems caespitose, erect, simple, slender, terete, sulcato-striate, fistular, 2-6 dm. high, scarcely 1 mm. in diameter at the middle; sheaths tightly convolute, oblong, obtuse, slender-aristate, nervose-striate, cartilaginous, about 1 cm. long; male inflorescence paniculate-cymose, narrow, 1–3 cm. long, containing 2–6 spikelets; spathes deciduous, sheath-like; spikelets ovate or cylindric, many-flowered, reddish, 0·5–1·5 cm. long; bracts closely imbricate, oblong-ovate, obtuse, cartilaginous, about 3·5 mm. long; perianth sessile, oblong, compressed, 2·5–3 mm. long; segments membranous; the outer lateral navicular, linear, acute; the anterior linear-oblong, obtuse; inner segments linear-oblong, obtuse, slightly exceeding the outer; female inflorescence spicate, containing 1–3 spikelets; spathes deciduous, sheath-like; spikelets erect, cylindric-lanceolate, or linear oblong, reddish, 1·5–1·8 cm. long; bracts about 12 in each spikelet, closely imbricate, lanceolate-oblong, acute, mucronate, cartilaginous, 6–10 mm. long; perianth sessile, oblong, 2–4·5 mm. long; segments oblong or linear-oblong, obtuse or acute, dorsally convex or flattened, membranaceous, reddish, subequal or unequal; ovary oblong, wrinkled, surmounted by a smooth, horny disc; styles deciduous, free; fruit stipitate, much exceeding the persistent perianth, subcylindric, slightly wider in the upper half than in the lower, narrowed towards the summit, smooth, shiny, horn-colour.

South Africa: Cape Province—Caledon Div.: Houwhoek, *Schlechter*, 7367, ♀, 7368, ♂, 7502, ♂; Zwartberg, *Guthrie in Bolus Herb.*, 14135, ♀.—Bredasdorp Div.: Mierkraal, *Schlechter*, 10514, ♂, 10515, ♀; hills near Rietfontein, *Schlechter*, 9682, ♀.—Ceres Div.: Karroo Poort, *Marloth*, 9057, ♂, 9058, ♀, 9100, ♀.—Clanwilliam Div.: Pretoris Kloof, between Piquiniers Kloof and Olifants River, *Drège*, 2484, ♂ and ♀; between Groen River and Waterval, *Drège*, 2488*bb*, ♂ and ♀.—Little Namaqualand, Ezels Kop, Kamiesberg, *Drège*, 2479, ♂, 2480, ♀.—Laingsburg Div.: Witte Bergen, near Matjesfontein, *Marloth*, 3141, ♂, 3142, ♂, *Bolus*, 13883, ♂ and ♀.—Prince Albert Div.: near Klaarstroom, Great Zwartberg, *Drège*, 9452, ♀; Sand River Mts., *Marloth*, 4325, ♂; Seven Weeks Poort, *Marloth*, 3163, ♀.—Montagu Div.: near Hot Baths, Montagu, *Mitchell in Bolus Herb.*, 15602, ♀, *Page in Bolus Herb.*, 16616, ♂ and ♀.—Riversdale Div.: Garcia's Pass, *Galpin*, 4810, ♂ and ♀ (monstrosity); Phisantefontein, north slopes of Lange Bergen, *Muir*, 3195, ♂, 3196, ♀.—George Div.: Montagu

Pass, *Schlechter*, 5827, ♂, 5829, ♀.—KNYSNA DIV.: Belvidere, *Duthie*, 805*a*, ♂ and ♀.—UNIONDALE DIV.: Wagenbooms River, in Long Kloof, *Drège*, 2022, ♂ and ♀; mountains near Uniondale, *Marloth*, 10970, ♂ and ♀; Prince Alfred's Pass, *Fourcade*, 2064*a*, ♂; Long Kloof, *Fourcade*, 2109, ♂ and ♀.—HUMANSDORP DIV.: Kromme River, *Drège*, 2484*b*, ♂ and ♀.—UITENHAGE DIV.: mountains near Elands River, *Zeyher*, ♀.

8. H. Willdenowia, *Mast. in Journ. Linn. Soc.*, x, 259 (1868)!; *op. cit.*, xiv, 418, sub 29 (1875); *in DC. Monog. Phan.*, i, 389, t. iv, figs. 7–15, t. v, fig. 17 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 136 (1897): **Willdenowia striata,** *Spreng., Syst. Veg.*, i, 188 (1825)!, non *Thunberg*: **Lepidanthus Willdenowia,** *Nees in Linnaea*, v, 665 (1830)!; *Drège, op. cit.*, xx, 242 (1847): **Restio sulcatus,** *Kunth, Enum.*, iii, 404 (1841)!; *Steud., Synops.*, ii, 253 (1855).

Stems closely set along creeping rhizomes, erect, simple, slender, compressed, sulcate-striate, fistular, pale buff, somewhat iridescent, 1·5–4 dm. high, 1·25–1·5 mm. across the flattened side; sheaths closely convolute, oblong, subacute, subulate-mucronate, coriaceous, finely striate, coloured like the stems or occasionally reddish, 1–2 cm. long; male spikelets terminal, solitary, oblong or linear-oblong, many-flowered, 1–2 cm. long; spathe persistent, sheath-like, about ½ as long as the spikelet; bracts closely imbricate, oblong, obtuse or subacute, subulate-mucronate, cartilaginous, pale reddish, yellowish at the margins, 7–8 mm. long; perianth sessile, much compressed, lanceolate, 7–8 mm. long, its apical portion protruding beyond the bract; outer segments lanceolate, acute, apiculate, membranous; the inner lanceolate, obtuse, hyaline, almost twice as long as the outer; female spikelets terminal, solitary, oblong or linear-oblong, 1·5–2 cm. long; spathe as in the male; bracts 5–10, closely imbricate, oblong, obtuse to acute, subulate-mucronate, cartilaginous, coloured like the male, 7–10 mm. long; flowers solitary in each spikelet; perianth incomplete or absent, when present 1–1·5 mm. long; segments adpressed to the ovary, oblong, acute, apiculate, hyaline; ovary stipitate, oblong, smooth, surmounted by a smooth, horny disc; styles free, subterete.

South Africa: without precise locality, *Thunberg*, ♀, *Berg*, ♀.

Cape Province—CAPE DIV.: Orange Kloof, *Wolley-Dod*, 2717, ♂; Steenberg Plateau, *Wolley-Dod*, 2716, ♂, *Pillans*, 4354, ♂; on the Muizenberg, *Bolus*, 4465, ♂, *Pillans*, 4140, ♂ and ♀; hills west of Simon's Town, *Pillans*, 4355, ♂; Klaver Vley, *Pillans*, 4353, ♂ and ♀; Black River, east of Mowbray, *Wolley-Dod*, 2718, ♀, 2719, ♂; Cape Flats between Cape Town and Simon's Town, *Burchell*, 8545, ♂; Doornhoogte, Cape Flats, *Ecklon and Zeyher*, ♂ and ♀.—STELLENBOSCH DIV.: Hottentots Holland, *Ecklon and Zeyher*, ♀; Sir Lowry's Pass, *Schlechter*, 4826, ♂.—CALEDON DIV.: Zwartberg, *Zeyher*, 4352, ♂, *Alexander*, ♂.—BREDASDORP DIV.: Schoon-

gezicht, Koude River, *Schlechter*, 10189, ♂, 10190, ♀.—TULBAGH DIV.: Tulbagh Kloof, *Ecklon and Zeyher*, ♂.—RIVERSDALE DIV.: near Zoetmelks River, *Burchell*, 6662, ♂.—KNYSNA DIV.: near the west end of Groene Vley, *Burchell*, 5646, ♂ and ♀; Belvidere, near Knysna, *Duthie*, 805, ♂ and ♀.

IX, CANNOMOIS, *Beauv. ex Desv. in Ann. Nat. Sc.*, xiii, 43, tab. 3, fig. 1 (1828); *Kunth, Enum.*, iii, 447 (1841); *Endl., Gen. Pl.*, Suppl. 2, p. 11 (1842); *Meisner, Gen.*, 408 (1842); *Steud., Synops.*, ii, 263 (1855); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 414 (1868); *Mast. in DC. Monog. Phan.*, i, 360, tab. iii, figs. 33–41 (1878); *Benth. et Hook., Gen. Pl.*, iii, 1036 (1883); *Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 10 (1888); *Mast. in Fl. Cap.*, vii, 141 (1897): **Cucullifera,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 451 (1836); *Kunth, Enum.*, iii, 484; *Meisner, Gen.*, 408; *Steud., Synops.*, ii, 264: **Mesanthus,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 451; *Kunth, Enum.*, iii, 484, partim; *Meisner, Gen.*, 408; *Steud., Synops.*, ii, 264: **Willdenowia d. Mesanthus,** *Endl., Gen. Pl.*, 121 (1836).

Flowers dioecious. Male spikelets many in panicled cymes, oblong, ovate or orbicular, compact, many-flowered. Perianth compressed; segments 6, the outer lateral navicular. Anthers oblong or elliptical, apiculate or muticous. Rudimentary ovary minute or absent. Female spikelets terminal and solitary, geminate or few, or many in spicate cymes, at first usually oblong, becoming ovate, acuminate, terete, 1–5-flowered, with few empty bracts, rarely perfecting more than 2 fruits, each subtended by a persistent spathe. Perianth obscure during the flowering period, clasping the ovary; segments 6, usually enlarging with the development of fruit to which they are closely appressed, rounded on the outer side or flattened. Staminodes minute or absent. Ovary oblong, somewhat compressed, 1-celled, often surmounted by a hard cap; styles 2, deciduous, free, attenuate. Fruit more or less stipitate, oblong, ovate-oblong or obovate, obtuse at apex, terete, subterete or compressed, on the adaxial side flattened or with a longitudinal depression, smooth or rugulose, glabrous or minutely setaceo-pubescent, woody, indehiscent.

Flowering stems closely set along creeping rhizomes, less often tufted, erect, terete, branched or simple. Leaf-sheaths persistent, closely convolute. Male inflorescence usually with several conspicuous deciduous spathes. Barren stems free or absent.

The genus is endemic.

Key based on Characters in the Female Plants.

Stems much branched, 1–3 m. high, 4–6 mm. in diameter at the middle . . (1) *virgata.*
Stems simple or sparingly branched, 3–7 dm. high, not exceeding 4 mm. in diameter:
Perianth-segments narrowed upwards from a relatively broad base, much less than half as long as the fruit:

Limb of perianth-segments transversely oblong, entire, obtusely emarginate or slightly crenulate at the upper margin . . . . . (4) *Drègei*.

Limb of perianth-segments oblong or subquadrate, toothed or lobed at the upper margin :

Outer and inner perianth-segments equal or subequal in diameter above the base, (2) *acuminata*.

Outer perianth-segments distinctly broader than the inner above the base :

Stems rigid, solid or with an interrupted, small central passage ; spikelets usually 3–8 . . . . . (3) *parviflora*.

Stems slender and flexible, fistular ; spikelets solitary . . (5) *aristata*.

Perianth-segments not narrowed upwards from a relatively broad base, oblong or spathulate-oblong, often perishing in their upper parts, with the ripening of the fruit, usually more than half as long as the fruit, or if less, then rounded and entire at the apex and not narrowed from the base upwards :

Spikelets solitary or very rarely in pairs ; stems simple, imperfectly fistular ; outer perianth-segments widened from their bases upwards to about the middle, (6) *nitida*.

Spikelets in pairs or solitary on the same plant ; stems occasionally branched in their upper parts, perfectly fistular ; outer perianth segments oblong, not wider at the middle than at the base . . . . . (7) *scirpoides*.

1. C. virgata, *Steud., Synops. Pl.*, ii, 263 (1855) ; *Mast. in Journ. Linn. Soc.*, x, 234 (1868) ; *in DC. Monog. Phan.*, i, 361 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 524 (1895) : [**Equisetum junceum nigrinodum,** *Breynius, Exot. Pl. Cent.*, 176, tab. 91 (1678)]. **Schoenus capensis,** *Burm. f., Fl. Cap. Prodr.*, 3 (1768), non *Linn.* : **Restio virgatus,** *Rottb., Program.*, 10 (1772) ; *ejusd. Descr. et Icon.*, p. 5, tab. i, fig. 2 (1773) ; *Thunb., Diss. Rest.*, 20 (1788) ; *in Usteri, Delect.*, i, 54 (1790) ; *Thunb., Prodr. Cap.*, 16 (1794) ; *Poir. in Lam., Encycl. Meth.*, vi, 168 (1804) ; *Willd., Sp. Pl.*, iv, pars 2, p. 728 (1806) ; *Pers., Syn. Pl.*, ii, 607 (1807) ; *Thunb., Fl. Cap.*, ed. 1, p. 338 (1811) ; ed. *Schultes*, 89 (1823) ; *Spreng., Syst. Veg.*, i, 186 (1825) ; *Mast. in Journ. Linn. Soc.*, xiv, 419 (1875) : **R. Scopa,** *Thunb., Diss.*, 19 (1788) ! ; *in Usteri, Delect.*, i, 54 ; *Thunb., Prodr. Cap.*, 15 ; *Poir. in Lam., Encycl. Meth.*, vi, 169 ; *Willd., Sp. Pl.*, iv, pars 2, p. 728 ; *Pers., Syn. Pl.*, ii, 607 ; *Thunb., Fl. Cap.*, ed. i, p. 337 ; ed. *Schultes*, 88 ; *Spreng., Syst. Veg.*, i, 186 ; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 417 : **Willdenowia compressa,** *Thunb. in Vet. Akad. Handl. Stockh.*, xi, p. 31, tab. 2, fig. 3 (1790) ! ; *Thunb., Prodr. Cap.*, 14 ; *Poir. in Lam., Encycl. Meth.*, vi, 178 ; *Willd., Sp. Pl.*, iv, pars 2, p. 717 ; *Pers., Syn. Pl.*, ii, 606 ; *Thunb., Fl. Cap.*, ed. 1, p. 315 ; ed. *Schultes*, 82 ; *Spreng., Syst. Veg.*, i, 188 ; *Nees in Linnaea*, v, 665 (1830) ; *Kunth, Enum.*, iii, 456 (1841) ; *Steud., Synops. Pl.*, ii, 263 (1855) ; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 421 ; *Mast. in DC. Monog. Phan.*, i, 398 : **Restio elegans,** *Poir. in Lam., Encycl. Meth.*, vi, 171 ; *Nees in Linnaea*, v, 645 : **Elegia paniculata,** *Pers., Syn. Pl.*, ii, 607 : **Cannomois cephalotes,** *Beauv. ex Desv. in Ann. des Sc. Nat.*, xiii, 43, tab. 3, fig. 1 (1828) ; *Drège, Zwei Pfl. Documente*, 82 (1844) ; *Steud., Synops. Pl.*, ii, 263 ;

Mast. in Fl. Cap., vii, 141 (1897); *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 12 (1900): **Mesanthus macrocarpus,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 451 (1836); *Kunth, Enum.*, iii, 485; *Steud., op. cit.*, 264: **Thamnochortus robustus,** *Kunth, op. cit.*, 436!; *Drège, op. cit.*, 81; *Hochst. in Flora*, 1845, p. 340; *Drège in Linnaea*, xx, 242 (1847): **T. virgatus,** *Kunth, op. cit.*, 436!; *Drège, op. cit.*, 70, 71: **Mesanthus macrospermus,** *Nees ex Drège in Linnaea*, xx, 242, nomen.

Stems arising sporadically from creeping rhizomes, erect, stout, terete, fistular, much branched in their upper parts, rugulose or nearly smooth, closely marked with sunken whitish speckles, 1–4 m. high, 8–12 mm. in diameter in the lower half; branches divided upwards several times into slender branchlets, flattened on the adaxial side; sheaths tightly convolute, ovate-oblong, acute, mucronate, coriaceous, 2·5–6 cm. long, each of the upper include one or several partly exserted, linear, pale scales which arise in the axil; male inflorescence paniculate-cymose, dense or lax, oblong to linear, usually 1–2·5 dm. long, occasionally up to 4·5 dm.; branches of the inflorescence mostly 2·5–5 cm. long, erect-spreading; spathes deciduous, sheath-like; spathellae inconspicuous, membranous, pale; spikelets very many, ovate or oblong, 4–10 mm. long; bracts closely appressed to the flowers, broadly ovate, acute, mucronate, cartilaginous, 2·5–3 mm. long; perianth sessile, much compressed, ovate, obtuse, 2·25–2·75 mm. long; segments oblong, obtuse, membranous; the outer lateral navicular, apiculate, narrowly keeled; the inner hyaline, pale, sometimes exceeding the outer; female spikelets terminal, solitary or rarely 2 or 3, adjacent in a spicate inflorescence, at first linear-oblong, becoming pear-shaped in the fruiting stage, acute, 2–4-flowered, 2–4 cm. long; spathes persistent, sheath-like, scarcely half as long as the spikelets which they closely embrace; bracts closely imbricate, ovate-oblong, acute, mucronate, coriaceous, membranous at the margins, 1–1·5 cm. long; perianth on a short, stout stipe, closely embracing the ovary, about 1·5 mm. long; segments broadly oblong, acute, entire or unevenly toothed at the apex, membranous, pale, subequal, lengthening with the growth of the fruit, ultimately 4–6 mm. long; ovary compressed, about equal with the perianth in length; styles 2, free, stout in their lower parts; fruit subsessile, oblong or ovate-oblong, obtuse at apex, distinctly compressed in the lower half, less so in the upper, finely rugulose, dark chestnut-brown, mostly 4–6 mm. long.

South Africa: without precise locality, *Oldenburg*, monstrous, *Thunberg*, ♂ and ♀, *Auge*, monstrous, *Masson*, ♂ and ♀, *Wallich*, ♂, *Burchell*, 5810, ♂, 5811, ♀, *Verreaux*, ♂ and ♀.

Cape Province—Cape Div.: Table Mt., *O. Kuntze*, ♂; Devil's Peak, *O. Kuntze*, ♂, *Pillans*, 4374, ♂; Kirstenbosch, *Page in Bolus Herb.*, 14337, ♂; Orange Kloof, *Pillans*, 4356, ♂ and ♀, 4362, ♂ and ♀; Noord Hoek Mts.,

Pillans, 4347, ♀; on the Muizenberg, *Tyson*, ♀.—PAARL DIV.: Dal Josaphat, *Tyson*, 840, monstrous; French Hoek Mts., *Pickstone*, 43, ♀; Bain's Kloof, *Bolus*, 4085, monstrous, 4086, monstrous, 4088, ♀.—CALEDON DIV.: near Knoblauch, by the Zonder Einde River, *Zeyher*, 1733, ♂; near Appels Kraal, by the Zonder Einde River, *Zeyher*, 1738 partly, ♂; Genadendal, Alexander, ♂.—TULBAGH DIV.: Witsenberg, *Burchell*, 8697, ♀, *Zeyher*, 1738 partly, ♂; Tulbagh Waterfall, *Ecklon and Zeyher*, ♂ and ♀; Winterhoek, *Bolus*, 7486, ♂; Sneuwgat, Gt. Winterhoek, *Phillips*, 1692, ♂ and ♀.—CERES DIV.: Mitchell's Pass, *Bolus*, 4088, ♀, 9661, ♂, 9662, ♀; mountains about Ceres, *Bolus*, 5481, ♀; Tweefontein, Koude Bokkeveld, *Schlechter*, 10117, ♂, 10118, ♀.—WORCESTER DIV.: Du Toit's Kloof, *Drège*, 1606, ♂ and ♀, 1607, monstrous.—VAN RHYNSDORP DIV.: Gift Berg, *Drège*, 139 partly, ♂, *Percy Sladen Expedition*, 7462, ♂ and ♀, 7618, ♂ and ♀.—SWELLENDAM DIV.: Duivels Bosch, near Swellendam, *Mund in Herb. Mus. Austr.-Afr.*, 13033, ♂.—RIVERSDALE DIV.: near base of Lange Bergen, near Kampsche Berg, *Burchell*, 7139, ♂ and ♀; between Vet River and Krombeks River, *Burchell*, 7163, ♂; Garcia's Pass, *Bolus*, 11410, ♂, 11411, ♀, *Schlechter*, 1973, ♂, *Galpin*, 4823, ♂ and ♀, 4827, monstrous; mountain plateau at De Hoek, *Muir*, 2892, ♂ and ♀.—MOSSEL BAY DIV.: Mossel Bay, *Rogers*, 4230, ♂, 4232, ♂, 4237, ♀.—LAINGSBURG DIV.: Tweedside, *Marloth*, 12065, sterile.—PRINCE ALBERT DIV.: Zwartberg Pass, *Tugwell in Bolus Herb.*, 41291, ♂.—KNYSNA DIV.: the Glebe, *Galpin*, 4826, monstrous, 4829, ♀; near Knysna, *Schönland*, 3610, ♂.—HUMANSDORP DIV.: Storms River, *Schlechter*, 5983, ♂; Hofman's Bosch, *Britten*, 1130, ♂; Zitzikama Mts., *Britten*, 1094, ♀; Witte Els Bosch, *Fourcade*, 1009, ♂, 2414, ♀.—UITENHAGE DIV.: Van Staden's River Mts., *Bolus*, 1646, monstrous; Witte Klip, *MacOwan*, 2151, monstrous; Elands River, *Schönland*, 3660, ♂.—ALBANY DIV.: Graham's Town, *MacOwan*, 645, monstrous.

Owing to the publication of the species "*Schoenus capensis*," the identity of which is, however, uncertain, in *Linn.*, *Centuria*, i, 4 (1755), Burmann's name, although accompanied by a reference to a figure, in *Breynius*, *Exot. Pl. Cent.*, which certainly represents the present species of *Cannomois*, is not valid.

2. C. acuminata, *Pillans*, comb. nov.: **Restio acuminatus,** *Thunb.*, *Diss.* 13 (1788)!; *in Usteri*, *Delect.*, i, 47 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Poir in Lam.*, *Encycl. Meth.*, vi, 176 (1804), excl. syn. *Rottb.*; *Willd.*, *Sp. Pl.*, iv, pars 2, 721 (1806), excl. syn. *Rottb.*; *Pers.*, *Syn. Pl.*, ii, 606 (1807), excl. syn. *Rottb.*; *Thunb.*, *Fl. Cap.*, ed. 1, 323 (1811), excl. syn. *Rottb.*; ed. *Schultes*, 84 (1823), excl. syn. *Rottb.*; *Spreng.*, *Syst. Veg.*, i, 184 (1825); *Kunth*, *Enum.*, iii, 413 (1841); *Mast. in Journ. Linn. Soc.*, xiv, 416 (1875): **Cucullifera dura,** *Nees in Lindl. Nat. Syst.*, ed. 2, 451 (1836)!; *Kunth*, *Enum.*, iii, 484; *Steud.*, *Synops.*, ii, 264 (1855): **Thamnochortus strictus,** *Kunth*,

Enum., iii, 438 ! ; *Drège, Zwei Pfl. Documente*, 70 (1844) ; *Steud., Synops.*, ii, 259 : **C. simplex,** *Kunth, Enum.*, iii, 448 ! ; *Drège, op. cit.*, 70, 71 ; *Steud., Synops.*, ii, 263 ; *Mast. in Journ. Linn. Soc.*, x, 237 (1868) ; *in DC. Monog. Phan.*, i, 363, t. 3, figs. 33–41, t. 4, fig. 15 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 524 (1895) ; *Mast. in Fl. Cap.*, vii, 143 (1897) : **Cuculliger durus,** *Nees ex Drège in Linnaea*, xx, 242 (1847) ! : **Restio micorbotrys,** *Nees, loc. cit., ined.* : **C. complanatus,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 19 (1900) !.

Stems caespitose or arising sporadically from creeping rhizomes, erect, simple or occasionally sparingly branched, rather slender, terete, fistular, more or less rugulose, often faintly sulcate-striate or pitted, 4–8 dm. high, 1–1·75 mm. in diameter at the middle ; sheaths tightly convolute, oblong or linear-oblong, acute, mucronate or shortly aristate, coriaceous, striate, ferruginous, mostly 1·5–3 cm. long ; male inflorescence laxly paniculate-cymose, oblong or linear-oblong, usually 3–6 cm. long ; spathes deciduous, lanceolate, acute to acuminate, mucronate, cartilaginous or coriaceous, faintly striate, reddish, yellow-speckled, the lower 3–6 cm. long ; rhachillae erect or spreading ; spathellae inconspicuous, membranous ; spikelets numerous, ovate or subrotund, 4–7 mm. long ; bracts loosely imbricate, ovate, acute to acuminate, mucronate, cartilaginous, ferruginous, pale-membranous at the margins, 2·5–4 mm. long ; perianth sessile, compressed, ovate, 1–2 mm. long ; segments oblong, acute, membranous ; the outer lateral navicular ; female spikelets 1–4, adjacent in spicate cymes, at first linear-cylindric, becoming ovoid and tapered at base, 3–5-flowered, 1·75–2·5 cm. long ; spathes sheath-like, erect, lanceolate, acuminate, coriaceous, red-brown, each about twice as long as its subtended spikelet ; bracts few, closely convolute, ovate to oblong, acute, mucronate or shortly aristate, coriaceous, red-brown, 8–12 mm. long ; perianth at first obscure, closely embracing the ovary, about 1 mm. long ; segments broad-based, widely separated and equal or subequal in diameter above their bases, unequal in length, at first ovate or subquadrate, becoming oblong, irregularly toothed or lobed at the apex, membranous, pale, up to 2 mm. long ; ovary ovate to oblong, with a firm cap ; styles 2, free, long, and slender, deciduous ; fruit shortly stipitate, oblong or slightly narrowed downwards from the middle, terete, subterete or semiterete, often grooved on the adaxial side, obtuse or acute at apex, smooth or rugulose, glabrous or sparsely setaceo-pubescent, dark brown or blackish.

South Africa : without precise locality, *Oldenburg*, ♂, *Thunberg*, ♂, *Auge*, ♂.

Cape Province—Malmesbury Div. : near Groene Kloof, *Bolus*, 4240, ♂ ; near Hopefield, *Bolus*, 12906, ♂.—Caledon Div. : Brakfontein, *Ecklon and Zeyher*, ♂ and ♀ ; Houwhoek, *Zeyher*, 4337 partly, ♂ and ♀, *Schlechter*,

7492, ♀.—Piquetberg Div.: Piquetberg, *Schlechter*, 7912, ♂, 7913, ♀.—Tulbagh Div.: near Tulbagh Waterfall, *Schlechter*, 1428, ♂.—Ceres Div.: mountains about Ceres, *Bolus*, 5479, ♀.—Van Rhyn's Dorp Div.: between Grasberg River and Waterval River, *Drège*, 101, ♂, 2514, ♀.

This species is referred to by Hochstetter in a note on p. 340 of *Flora*, 1845. It was named in various herbaria as "*Cuculliger microbotrys*" by Nees.

3. C. parviflora, *Pillans*, comb. nov.: **Restio parviflorus,** *Thunb., Diss.*, 13 (1788)!; *in Usteri, Delect.*, i, 48 (1790); *ejusd. Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 176 (1804); *Willd., Sp. Pl.*, iv, pars 2, 722 (1806); *Pers., Syn. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 325 (1811); ed. *Schultes*, 85 (1823); *Spreng., Syst. Veg.*, i, 184 (1825); *Nees in Linnaea*, v, 655 (1830), excl. var. omn.; *Thunb. Herb. ex Mast. in Journ. Linn. Soc.*, xiv, 416 (1875): **C. Schlechteri,** *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 18 (1900)!: **C. spicatus,** *Mast., op. cit.*, p. 19!: **C. scirpoides,** *Marloth, Fl. S. Afr.*, iv, 64, fig. 14*c*, tab. 16*c* (1915), non *Mast.*

Stems caespitose or arising sporadically from creeping rhizomes, erect, simple or sparingly branched in their upper parts, terete, rigid, solid or with the central passage almost closed with pith, smooth or finely rugulose, often white-speckled, mostly 5–10 dm. high, 2–3 mm. in diameter at middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, nervose-striate, red-brown, thinner and paler at the margins, mostly 2·5–3·5 cm. long; male inflorescence erect, paniculate-cymose, linear-oblong to linear, narrowed in its upper half, rather lax, 4–20 cm. long; spathes caducous, sheath-like but broader; rhachillae 1–several at each node of the inflorescence, erect-spreading, branched or simple, up to 4·5 cm. long; spikelets numerous, at first ovate, becoming subglobose, 3–6 mm. long; bracts loosely imbricate, ovate, rotundate or orbicular, acute or rounded at apex, muticous or mucronate, cartilaginous, reddish, pale-membranous at the margins, 1·5–3 mm. long; perianth sessile, much compressed, rotundate, rounded or obtuse at apex, 1–2·5 mm. long; outer segments oblong, cartilaginous, reddish, pale-membranous at the margins; the anterior subacute or obtuse; the lateral navicular, more or less carinate, acute; inner segments oblong, obtuse, membranous, pale or reddish, equalling or slightly exceeding the outer; female inflorescence spicate-cymose, linear, 1–2 dm. long; spathes subpersistent, erect, embracing the spikelets, lanceolate, acuminate, coriaceous, chestnut-brown or paler, 3–5 cm. long; spikelets approximate, several or many, lanceolate, acute, 1–4-flowered, 2–3 cm. long; bracts many, closely convolute, lanceolate, acute, mucronate, coriaceous, chestnut-brown, hyaline-membranous at the margins, mostly 1–2 cm. long; perianth shortly stipitate, at first

obscure, developing with the growing ovary; segments broad-based, narrowing upwards into a short limb, lobed or toothed at the upper margin, membranous, at first pale, becoming light brown; the outer 1 mm. long, distinctly broader above the base than the inner; inner segments 0·5–1 mm. long; ovary sessile, oblong, with a hard cap; fruit oblong, obtuse, subterete, with a longitudinal depression on the adaxial side, minutely rugulose, chestnut-brown.

South Africa: without precise locality, *Thunberg*, ♂.

Cape Province—Caledon Div.: mountains of Baviaans Kloof, *Burchell*, 7874, ♂; mountains at Villiersdorp, *Schlechter*, 9913, ♂, 9914, ♀.—Ceres Div.: Blauwberg, *Schlechter*, 8467, ♂, 8468, ♀.—Worcester Div.: mountains above Worcester, *Rehmann*, 2674, ♂; Hex River Mts., *Bolus*, 13214, ♀; Wilde Paarde Berg, *Stokoe in Bolus Herb.*, 17672, ♂ and ♀.

4. C. Drègei, *Pillans*, nom. nov.: **Thamnochortus scirpoides,** *Kunth, Enum.*, iii, 438 (1841)!; *Drège, Zwei Pfl. Documente*, 122 (1844); *Steud., Synops.*, ii, 259 (1855).

Stems erect, simple, rigid, terete, solid, rugulose or nearly smooth, yellowish or buff when dry, usually 7–9 dm. high, 2·5–3 mm. in diameter at middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, conspicuously nervose-striate, purple-brown, pale-membranous at the margins, mostly 2·5–3·5 cm. long; male inflorescence paniculate-cymose, rather lax, oblong or linear-oblong, usually 6–10 cm. long, up to 20 cm.; rhachillae two or several at each node of the rhachis, branched or simple; spathes caducous, sheath-like but broader; spikelets at first ovate, becoming orbicular, 3–4 mm. long; bracts loosely imbricate, ovate, acute, muticous or mucronulate, cartilaginous, reddish, pale at the margins, 2–3 mm. long; perianth sessile, rotundate, about 2·5 mm. long; outer segments oblong, obtuse, cartilaginous, red, the lateral navicular; inner segments oblong or spathulate-oblong, broadly rounded at the apex, membranous, equalling the outer; female inflorescence spicate, linear, about 1 dm. long; spathes sheath-like, persistent, erect and clasping the spikelets, chestnut-brown, each much exceeding its subtended spikelet; spikelets sessile, lanceolate, terete, 1–3-flowered, about 2 cm. long, usually developing only 1 fruit; bracts closely imbricate, ovate-lanceolate, acute, mucronate, coriaceous, red-brown, pale-membranous at the margins, mostly 1–1·5 cm. long; perianth at first obscure, becoming more evident with the development of the fruit, the base of which it closely embraces; outer segments narrowed upwards from a broad base into a transversely oblong limb, entire, obtusely emarginate or slightly crenulate at the upper margins, membranous, brownish, 1–1·5 mm. from base to upper margin, 2–2·25 mm. between the sides; inner segments, narrower at base and more sharply narrowed upwards, equalling the outer in length or slightly

shorter; fruit oblong or narrow-oblong, obtuse and emarginate at apex, flattened on the adaxial side, almost smooth, blackish, about 1 cm. long.

South Africa: Cape Province—Laingsburg Div.: Witteberg, near Matjesfontein, *Bolus*, 13884, ♀, 13885, ♂.—Prince Albert Div.: Great Zwartberg, near Vrolyheid, *Drège*, 100, ♂; Zwartberg Pass, *Tugwell in Bolus Herb.*, 14286, ♂.—Riversdale Div.: Garcia's Pass, *Muir*, 3184, ♂.—Uniondale Div.: Welgelegen, in Long Kloof, *Drège*, 2023, ♂; hills near Avontuur, *Fourcade*, 2081, ♂; Uniondale Road, *Paterson*, 3015 partly, ♀.

The specific name "*scirpoides*" having been used by Masters for his species of *Cannomois*, now valid, which he believed to be con-specific with *Thamnochortus scirpoides*, Kunth, it became necessary to bring into use a new name for the present species.

5. C. aristata, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 19 (1900)!.

Stems caespitose, erect, simple, slender, terete, slightly fistular, rugulose, yellow-speckled, 6–8 dm. high, scarcely 1 mm. in diameter at middle; sheaths tightly convolute, linear-oblong, acuminate, slender-aristate, cartilaginous, faintly nervose, ferruginous, mostly 4–5 cm. long without the awn; awn filiform, about 12 mm. long; male inflorescence paniculate-cymose, oblong or linear-oblong, rather lax, 3–6 cm. long; rhachillae erect-spreading, branched or simple, very slender, up to 1·5 cm. long; spathes caducous, sheath-like, subchartaceous, the lower nearly as long as the inflorescence; spathellae persistent, lanceolate, acuminate, aristate; spikelets ovate, 3·5–5 mm. long; bracts loosely imbricate, ovate, acute, mucronate, cartilaginous, reddish, pale-membranous at the margins, 2·75–3 mm. long; perianth sessile, rotundate, much compressed, 2 mm. long; outer segments spathulate-oblong, acute, apiculate, cartilaginous, reddish; the lateral navicular; inner segments oblong, obtuse, hyaline-membranous, equalling the outer; female spikelets terminal, solitary, linear-oblong, tapered at base, terete, 2- or 3-flowered, 3–4 cm. long; spathe sheath-like but shorter, embracing the base of the spikelet; bracts several, closely imbricate, lanceolate, acuminate, aristate, cartilaginous, becoming coriaceous, ferruginous, 2–3 cm. long; perianth at first obscure during the flowering period, developing with the fruit, the base of which it tightly embraces; segments narrowed upwards from a broad base, imbricate in their lower parts, toothed or lobed at the upper margins, membranous; the outer subquadrate; the inner oblong, longer and narrower than the outer; styles caducous, long and slender; fruit oblong or slightly wider in the upper than in the lower half, obtuse at apex, somewhat depressed and flattened on its adaxial side.

South Africa: Cape Province—Clanwilliam Div.: Koude Berg, *Schlechter*, 8752, ♂, 8753, ♀.

6. C. nitida, *Pillans*, comb. nov.: **Hypodiscus nitidus,** *Mast. in Journ. Linn. Soc.*, x, 259 (1868)!; *in DC. Monog. Phan.*, i, 383 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 523 (1895); *Mast. in Fl. Cap.*, vii, 136 (1897); *in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 16 (1900).

Stems caespitose, erect, simple, wiry, terete, rugulose, somewhat fistular, 3–7 dm. high, 1·5–2 mm. in diameter at middle; sheaths tightly convolute, oblong or linear-oblong, acute, subulate-mucronate, coriaceous, almost smooth or nervose, red-brown, 2–4 cm. long; male inflorescence paniculate-cymose, narrow, rather lax, 2·5–3·5 cm. long; rhachis much compressed, erect; rhachillae few, short, each bearing one spikelet; spathes sheath-like, deciduous, the lowermost about as long as the inflorescence; spikelets usually 4–8, obovoid or rotundate, 8–10 mm. long; bracts loosely imbricate, lanceolate, acuminate, mucronate, cartilaginous, light brown, 5–10 mm. long, the lowermost usually noticeably longer than the middle or upper ones; perianth sessile, much compressed, ovate or rotundate, 2·75–3 mm. long; segments ovate-oblong, acute; the outer cartilaginous; the inner hyaline-membranous, slightly shorter than the outer; female spikelets solitary, terminal, very rarely paired, oblong, narrowed at base, 1–3-flowered, 2–3 cm. long; spathes persistent, clasping the base of the spikelet, bract-like, lanceolate, acute or acuminate, subulate-mucronate, smooth, red-brown, slightly more than $\frac{2}{3}$ as long as the spikelet; bracts shorter and broader, closely convolute, perianth sessile, developing with the fruit and enfolding it, 3–5 mm. long; segments spathulate-oblong, obtuse, membranous, subequal, $\frac{2}{3}$ as long as the fruit; styles deciduous, free; fruit ovate-oblong, somewhat flattened on its adaxial side.

South Africa: Cape Province—Tulbagh Div.: Tulbagh Kloof, *Ecklon*, ♂; on the Winterhoek Mt., *Ecklon*, ♂ and ♀.—Ceres Div.: Tafelberg in Koude Bokkeveld, *Schlechter*, 10084, ♂, 10085, ♀.—Worcester Div.: Onklaarberg, *Stokoe*, 1204, ♂.—Laingsburg Div.: Witteberg, near Matjesfontein, *Compton in Bolus Herb.*, 18367, ♀.

This is *Restio nitidus* of Nees in manuscript.

7. C. scirpoides, *Mast. in Journ. Linn. Soc.*, x, 236 (1868)!; *in DC. Monog. Phan.*, i, 362 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 524 (1895); *Mast. in Fl. Cap.*, vii, 142 (1897): **C. congesta,** *Mast. in op. cit.*, 143!.

Stems caespitose or arising sporadically from creeping rhizomes, erect, simple or sparingly branched in their upper parts, terete, fistular, rugulose, 5–10 dm. high, about 2 mm. in diameter at middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate or aristate, coriaceous, membranous at the margins, nervose-striate, red-brown, yellow-speckled, mostly 3–3·5 cm. long; male inflorescence paniculate-cymose, linear-oblong, dense, usually 6 or 7 cm. long; rhachis geniculate, compressed;

rhachillae 1-several from each node of the rhachis, erect, branched or simple; spathes caducous, sheath-like but broader; spikelets ovate to oblong, obtuse, 3–7 mm. long; bracts loosely imbricate, ovate, acute or acuminate, mucronate or shortly aristate, cartilaginous, reddish, paler and membranous at the margins, 3–4 mm. long; perianth sessile, much compressed, ovate, 1·75–2 mm. long; segments membranous; the outer oblong-lanceolate, acute, mucronulate, reddish; the inner ovate, obtuse, pale; female inflorescence spicate; spikelets 1 or 2, oblong, tapered at both ends, 1–4-flowered, 3–4 cm. long; spathes persistent, sheath-like, each about half as long as its subtended spikelet; bracts closely convolute, lanceolate, acute, mucronate, coriaceous, at first reddish and yellow-spotted, becoming chestnut-brown, mostly 1·5–2 cm. long; perianth shortly stipitate, closely embracing the ovary and about 1 mm. long during the flowering period, lengthening with the developing fruit, to which it closely adheres and nearly equals in length; segments oblong, rounded or subacute at apex, 1 nerved, membranous, pale, about equal in length and breadth, often perished in their upper parts with the ripe fruit; styles caducous, long, free, with the stigmatic portion reaching nearly to the base; fruit oblong, somewhat compressed, more or less flattened and grooved on the adaxial side, blackish, minutely rugulose, 6–10 mm. long.

South Africa: Cape Province—Caledon Div.: Zwartberg, *Ecklon and Zeyher*, ♂ and ♀, *Pillans in Bolus Herb.*, 15482, ♂ and ♀; Donkerhoek Mt., *Burchell*, 7960, ♀; Houwhoek, *Galpin*, 4801*a*, ♂.—Paarl Div.: French Hoek Mountains, *Pickstone*, 17, ♂.—Tulbagh Div.: Tulbagh Kloof, *MacOwan*, 1682, ♂.—Worcester Div.: Onklaar Berg, *Stokoe*, 1200*a*, ♂, 1200*b*, ♀.—Clanwilliam Div.: Cedar Bergen, near Ezelsbank, *Drège*, 2508, ♂ and ♀.

Var. β, Primosii (*Pillans*); spikelets of the male plant mostly larger than in the species, and bracts with a long, pale awn; fruit much compressed, 8–9 mm. long, 4·5–5 mm. in diameter, having at its base the lower portions of the partly perished perianth.

Cape Province—Clanwilliam Div.: Cedar Bergen, *Primos in Marloth, Herb.*, 11796, ♂, 11802, ♀.

Var. γ, minor (*Pillans*); stems slender; female spikelets smaller than in the species; perianth scarcely half as long as the fruit, 5–6 mm. long.

Cape Province—Caledon Div.: mountains between Villiersdorp and French Hoek, *Bolus*, 7485, ♀.

This species is in several herbaria named *Mesanthus Ricinus* by Nees.

X, WILLDENOWIA, *Thunb. in Vet. Akad. Handl. Stockh.*, xi, 226, tab. ii, figs. 1, 2 (1790); *Willd., Sp. Pl.*, iv, pars 2, p. 717 (1806); *Pers.*,

Synops. Pl., ii, 606 (1807); *Aiton, Hort. Kew.*, v, 367 (1813); *Thunb., Fl. Cap.*, ed. *Schultes*, 82 (1823); *Linn., Syst. Pl.*, ed. 16, i, p. 129 (1825); *Nees in Linnaea*, v, 664 (1830); *Endl., Gen. Pl.*, 121 (1836); *Harvey, Gen. S. Afr. Pl.*, 356 (1838); *Kunth, Enum.*, iii, 452 (1841); *Endl., Gen.*, Suppl. 2, p. 11 (1842); *Meisner, Gen.*, 408 (1842); *Steud., Synops. Pl.*, ii, 262 (1855); *Harv., Gen. S. Afr. Pl.*, ed. 2, p. 415 (1868); *Mast. in DC. Monog. Phan.*, i, 391, tab. iv, figs 21–29, tab. v, figs. 19*a*, 19*b* (1878); *Benth. et Hook., Gen. Pl.*, iii, 1036 (1883), excl. *Anthochortus; Hieron. in Engler et Prantl, Natur. Pflanzen*, ii, § 4, p. 10 (1888); *Mast. in Fl. Cap.*, vii, 143 (1897): **Nematanthus,** *Nees in Linnaea*, v, 661 (1830); *Harvey, Gen. S. Afr. Pl.*, 355 (1838): **Ceratocaryum,** *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 451 (1836); *Endl., Gen.*, p. 121; *Kunth, Enum.*, iii, 482; *Meisner, Gen.*, 408; *Steud., Synops.*, ii, 264; *Harv., Gen. S. Afr. Pl.*, ed. 2, p. 415; *Mast. in DC. Monog. Phan.*, i, 390, tab. iv, figs. 16–20, tab. v, figs. 18*a*, 18*b*; *Benth. et Hook., Gen. Pl.*, iii, 1037; *Mast. in Fl. Cap.*, vii, 147.

Flowers dioecious. Male flowers many in racemes, panicles or lax spikelets, each subtended by a deciduous, linear, or setaceous bract; perianth-segments 6, linear or setaceous, chartaceous or membranous, the outer distinctly longer than the inner. Anthers oblong, apiculate. Rudimentary ovary minute. Female spikelets 1–several in spicate cymes, each subtended by a conspicuous, persistent spathe, oblong 1- (the flower occupying a terminal position) or rarely 2-flowered, with several imbricate, empty bracts below the flower. Perianth sessile or on a short fleshy stipe, terete, clasping the ovary; segments 6 or fewer, or absent, usually unequal. Staminodes ligulate, minute. Ovary sessile or stipitate, oblong or globose, usually surmounted by a hard cap, 1-celled; styles 2, free or rarely shortly connate at base. Fruit barrel-shaped, ovate or globose, terete, usually pitted, sometimes tubercled, bony, indehiscent.

Flowering stems arising from creeping rhizomes or tufted, erect, branched or simple, terete, rarely sulcate or striate. Leaf-sheaths persistent, closely convolute. Male inflorescence with conspicuous, deciduous spathes. Barren stems few or absent.

The genus is endemic.

Key based on Characters in the Female Plants.

Perianth sessile:
- Stems smooth, wrinkled or rugulose:
  - Stems simple:
    - Stems slender, 2–3 dm. high . . . . . (12) *humilis.*
    - Stems stout, at least 5 dm. high:
      - Stems solid or in parts narrowly fistular . . . . (1) *argentea.*
      - Stems widely fistular in all parts . . . . . (2) *fistulosa.*

Stems branched :
Perianth-segments 6, 2–2·5 mm. long . . . . . (5) *affinis.*
Perianth-segments 3, 0·5 mm. long . . . . . (11) *purpurea.*
Stems striate . . . . . (9) *striata.*
Perianth stipitate :
Stems simple . . . . . (3) *fimbriata.*
Stems branched :
Stems striate or sulcate :
Stipe of perianth entire ; perianth 3–4 mm. long . . . . (8) *sulcata.*
Stipe of perianth lobed ; perianth 1·5 mm. long . . . (10) *Bolusii.*
Stems neither striate nor sulcate :
Perianth-segments all imbricate at their margins :
Segments distinctly narrowed at base . . . . . (6) *arescens.*
Segments narrowing upwards from a broad base . . . . (7) *teres.*
Perianth-segments not or rarely some imbricate at their margins, (4) *Lucaeana.*

1. W. argentea, *Hieron. in Engler et Prantl, Natur. Pflanzen,* ii, § 4 (tab.), p. 10 (1888) : **Restio argenteus,** *Nees in Linnaea,* v, 656 (1830), excl. syn. *Thunb., Willd. et Spreng.* : **Ceratocaryum argenteum,** *Kunth, Enum.,* iii, 483 (1841) ! ; *Steud., Synops.,* ii, 264 (1855) ; *Mast. in Journ. Linn. Soc.,* x, 273 (1868) ; *in DC. Monog. Phan.,* i, 390 (1878) ; *Durand et Schinz, Consp. Fl. Afr.,* v, 526 (1895) ; *Mast. in Fl. Cap.,* vii, 147 (1897).

Stems erect, simple, almost straight, stout and rigid, terete, solid or interruptedly somewhat fistular, minutely rugulose, 1–2·5 m. high, 4–5 mm. in diameter at the middle ; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, deeply membranous along the upper margins, with the upper parts soon becoming chartaceous and disintegrating, 4–10 cm. long ; male inflorescence erect, paniculate-cymose, dense, 6–12 cm. long ; spathes caducous, expanded, oblong-lanceolate, acute, cartilaginous, smooth, nerve-marked, brown, about 7 cm. long ; each node of the rhachis with a callous-like thickening and bearing several racemes ; racemes oblong to ovate, densely many-flowered, 1–1·5 cm. long ; spathellae lanceolate, hyaline, about 1 cm. long ; bracts expanded, linear or linear-lanceolate, long-acuminate, membranous, whitish or silvery, much exceeding the flowers ; perianth shortly pedicellate, narrow-oblong, more or less arcuate, 4·5–6 mm. long ; segments membranous, whitish ; the outer linear, attenuate ; the inner lanceolate, acuminate, shorter ; female inflorescence spicate, narrow-oblong, containing 4–6 spikelets, 6–12 cm. long ; spathes subpersistent, loosely convolute, resembling those of the male inflorescence ; spikelets sessile, oblong, 1- or 2-flowered, 3–4 cm. long ; bracts loosely convolute, about 12 in number, lanceolate to linear-lanceolate, 1-nerved, chartaceous, whitish, 1·5–3 cm. long ; perianth sessile, closely appressed to the ovary, 2–3 mm. long ; segments broad-based, with margins overlapping, suborbicular, apiculate or toothed at apex, cartilaginous or membranous ; the inner shorter than the outer ; ovary sessile, globose, more

or less tubercled on its upper parts; styles 2, free, erect-spreading, semiterete, acute, channelled up the inner side, with the stigmatic surface extending over the entire length, 1·2–2 cm. long; fruit ovate or subglobose, depressed at the apex, black and smooth or tessellate on the lower half, red and tubercled on the upper, or studded all over with angular, flat-topped tubercles.

South Africa: Cape Province—CALEDON DIV.: Houwhoek, *Burchell*, 8074, ♂; Baviaans Kloof, near Genadendal, *Burchell*, 7656 partly, ♂; mountains near Grietje's Gat, *Ecklon and Zeyher*, ♂ and ♀; Elim, *Schlechter*, 7758, ♂, 7759, ♀; north slopes of Viljoen's Pass, *Pillans*, 4812, ♀.—RIVERSDALE DIV.: near Albertinia, *Muir*, 1322, ♂ and ♀.

Nees applied his manuscript name "*Ceratocaryum speciosum*" to plants of this species in various herbaria.

2. W. fistulosa, *Pillans*, comb. nov.: **Ceratocaryum fistulosum,** *Mast. in Journ. Linn. Soc.*, x, 274, tab. 8, fig. E (1868)!; *in DC. Monog. Phan.*, i, 391, tab. 4, figs. 16–20, tab. 5, fig. 18 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 526 (1895); *Mast. in Fl. Cap.*, vii, 148 (1897).

Stems erect, unbranched, terete, widely fistular within, obsoletely rugulose, yellowish (in herbarium specimens), 6–15 dm. high, 6–8 mm. in diameter at the middle; sheaths tightly convolute, oblong-lanceolate, acute, mucronate, coriaceous, cartilaginous in their upper parts, lacerate and membranous at the margins, obsoletely tubercled, nervose-striate, mostly 4–6 cm. long; male inflorescence paniculate-cymose, dense, about 5 cm. long; spathes caducous, expanded, sheath-like; each node of the rhachis with a callous-like thickening and bearing 1–several racemes; racemes ovate to oblong, densely many-flowered, 1–1·5 cm. long; bracts erect-spreading, linear, acuminate, expanded, membranous, whitish, much exceeding the flowers; perianth pedicellate, oblong, somewhat arcuate, 4–5 mm. long; segments membranous, whitish; the outer linear, attenuate upwards; the inner oblong-lanceolate, acuminate, shorter; female inflorescence spicate, linear-oblong, 7–9 cm. long; spathes persistent, loosely convolute, sheath-like; spikelets 3–4, sessile, 1-flowered, hidden by the spathes; bracts several, loosely imbricate, expanded, lanceolate, attenuate upwards, cartilaginous, 6–12 mm. long; perianth sessile, tightly clasping the ovary, 2·5–3 mm. long; segments unequal, ovate to oblong, obtuse, apiculate and variously toothed on the upper margin; styles 2, free, short, densely clothed with stigmatic hairs; fruit globose, tubercled, reddish.

South Africa: Cape Province—RIVERSDALE DIV.: on the Kampsche Berg, *Burchell*, 7095, ♂ and ♀.

This plant is in Hooker's herbarium with Burchell's manuscript name "*Restio fistulosus.*" Further collectings may show the advisability of

placing this species as a variety of *W. argentea*, Hieron., from which it appears to differ chiefly in having fistular stems.

3. W. fimbriata, *Kunth, Enum.*, iii, 455 (1841)!; *Drège, Zwei Pfl. Documente*, 82, 116 (1844); *Steud., Synops.*, ii, 263 (1855); *Mast. in Journ. Linn. Soc.*, x, 271 (1868); *in DC. Monog. Phan.*, i, 394 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895); *Mast. in Fl. Cap.*, vii, 147 (1897): **W. decipiens,** *N. E. Br. in Fl. Cap.*, vii, 758 (1900)!.

Stems erect, simple, terete, solid, finely pitted, yellowish when dry, 5–15 dm. high, about 2·5 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acuminate, mucronate, coriaceous, soon becoming lacerate in their upper parts, obsoletely nervose-striate, yellowish, or with the upper parts ferruginous, 3–6 cm. long; male inflorescence linear-oblong, 6–8 cm. long, containing many-flowered racemes and panicles which are congested in the axils of the spathes; spathes 2 or 3, subpersistent, oblong-lanceolate, acuminate, stoutly mucronate, incurved along the upper margins, chestnut-brown, shiny, nervose-striate, 5–7 cm. long; racemes and panicles ovate-oblong, about 1 cm. long; bracts erect-spreading, expanded, linear-lanceolate, acuminate, membranous, pale, about 8 mm. long; perianth pedicellate, lanceolate or linear-oblong, somewhat curved, 4–6 mm. long; segments linear or linear-lanceolate, acuminate, terminating in a short awn, pale-membranous; the inner distinctly shorter than the outer; female inflorescence spicate, 8–12 cm. long; spathes as in the male but longer; spikelets 1–3, sessile, 1-flowered, 1·5–2 cm. long; bracts several, tightly convolute, ovate-lanceolate, acute, coriaceous, about as long as the spikelet; perianth on a stout fluted stipe, 2–2·5 mm. long; segments broad-based, imbricate at the margins, ovate to suborbicular, emarginate and toothed at the apex, membranous; the inner distinctly shorter than the outer; styles free, short and stout; fruit cylindric, depressed at the apex, rugulose or nearly smooth, dark chestnut-brown.

South Africa: Cape Province—Caledon Div.: Baviaans Kloof, near Genadendal, *Burchell*, 7905, ♂, 7656 partly, ♂; Genadendal, *Drège*, 1635, ♀, 1635*a*, ♀; Houwhoek, *Schlechter*, 7447, ♂, 7448, ♀.—Worcester Div.: Du Toit's Kloof, *Drège*, 9611, ♂, 1635*b*, ♀, *Bolus*, 4092, ♂.—Riversdale Div.: Garcia's Pass, *Galpin*, 4828, ♂ and ♀, *Bolus*, 11412, ♀.

4. W. Lucaeana, *Kunth, Enum.*, iii, 455 (1841)!; *Drège, Zwei Pfl. Documente*, 74, 110 (1844); *Steud., Synops.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 271, t. 8, fig. *d* (1868); *in DC. Monog. Phan.*, i, 392, t. iv, figs. 21–23, 26–29, t. v, fig. 19 (1878); *in Journ. Linn. Soc.*, xxi, 590, No. 12 (1885); *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895); *Mast. in Fl. Cap.*, vii, 146 (1897); *Marloth, Fl. S. Afr.*, iv, fig. 13*b* (1915): **Restio glomeratus,** *Thunb., Diss.*, 18 (1788)!, monstrositas; *in Usteri, Delect.*,

i, 52 (1790); *Thunb., Prodr. Cap.*, 15 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 170 (1804); *Willd., Sp. Pl.*, iv, pars 2, 726 (1806); *Pers., Syn. Pl.*, ii, 607 (1807); *Thunb., Fl. Cap.*, ed. 1, 334 (1811); ed. *Schultes*, 88 (1823); *Spreng., Syst. Veg.*, i, 185 (1825); *Kunth, Enum.*, iii, 414; *Steud., Synops.*, ii, 254; *Mast. in Journ. Linn. Soc.*, viii, 226, 254 (1865); *op. cit.*, x, 279 (1868); *op. cit.*, xiv, 418 (1875); *in Fl. Cap.*, vii, 98.

Stems arising from creeping rhizomes, erect, moderately branched or simple, terete, solid or somewhat fistular, with minute sunken yellowish spots, 3–9 dm. high, 1·5–3 mm. in diameter in their lower parts; sheaths closely convolute, or loose in their upper parts, oblong-lanceolate, acute, aristate, coriaceous, deeply membranous at the sides and apex, nervose-striate, mostly 1·5–3 cm. long; male inflorescence 4–6 cm. long, containing racemes and panicles clustered in the axils of the spathes; spathes deciduous, expanded, sheath-like, 3–4 cm. long; racemes and panicles many-flowered, shorter than the subtending spathes; bracts deciduous, linear or setaceous, membranous, much exceeding the flowers; perianth pedicellate, 2–2·5 mm. long; segments spreading, setaceous, usually twisted; female inflorescence spicate, containing 1–3 spikelets; spathes deciduous, loosely convolute, sheath-like, 2·5–4 cm. long; spikelets sessile, erect, cylindric, 1-flowered, 1·5–2·5 cm. long; bracts about 6, convolute, ovate to oblong-lanceolate, acute, mucronate or aristate, cartilaginous, pale reddish, 1·2–2·2 cm. long; perianth on a stout, lobed stipe, 0·75–2 mm. long, occasionally incomplete or absent; segments distinct, usually not touching at the margins, setaceous, linear or oblong, not apparently widest at the base, slightly widened and emarginate or dentate at the apex, membranous; ovary oblong, surmounted by a horny disc; styles free, 8–15 mm. long; fruit barrel-shaped, smooth or sparsely but conspicuously pitted, shiny, black.

South Africa: without precise locality, *Thunberg*, ♂ (monstrosity), *Banks*, ♂.

Cape Province—Cape Div.: north slopes of Table Mt., *Pillans*, 4299, ♂ and ♀, 4357, ♂ and ♀; on the Steenberg, *Wolley-Dod*, 2583, ♀, 2591, ♀, *Pillans*, 2965, ♂, 2966, ♀; base of the Muizenberg, *Bolus*, 7224, ♂.—Caledon Div.: Donkerhoek Mt., *Burchell*, 7961, ♂ and ♀; between Donkerhoek and Houwhoek Mts., *Burchell*, 8010 (monstrosity); Houwhoek, *Ecklon*, 4351, ♀, *Schlechter*, 7773, ♂, 7774, ♀; south slopes of Viljoen's Pass, *Pillans*, 4810, ♂ and ♀.—Paarl Div.: Bain's Kloof, *Bolus*, 4085 (monstrosity), 4094, ♀.—Clanwilliam Div.: Pretoris Kloof, between Piquiniers Kloof and Olifants River Mts., *Drège*, 2515, ♀, *Stephens in Sladen Expedition*, 7128, ♂ and ♀, 7138, ♂, 7139, ♂; Wupperthal, *Drège*, 2515*a*, ♀.—Van Rhyn's Dorp Div.: Gift Berg, *Phillips*, 7463, ♂.

This species was given the MS. name "*Spirostylis Ecklonii*" by Nees

in various herbaria. Thunberg's type specimens of *Restio glomeratus* bear inflorescences of monstrous form without flowers; because of that and the unsuitable trivial name, as regards normal inflorescences, there seems to be sufficient reason for not adopting the older name in the case of this species.

5. W. affinis, *Pillans*, sp. nov.; culmis ramisque teretibus albido-lepidotis; vaginis arcte convolutis aristatis superne membranaceis; floribus masculis pedicellatis in axillares racemos vel paniculas dispositis; spiculis femineis 1–3 cylindraceis erectis spathis deciduis vaginiformibus laxe convolutis suffultis; bracteis convolutis lanceolatis cartilagineis; perianthio sessili; segmentis ad margines imbricatis oblongis vel ovato-oblongis apice rotundatis emarginatis membranaceis; ovario disco corneo superato; stylis liberis oblongis vel lanceolatis saepe apice recurvis.

Stems erect, on creeping rhizomes, moderately branched, terete, somewhat fistular, smooth, closely marked with minute whitish or buff-coloured spots, 6–8 dm. high, 2–3 mm. in diameter in their lower parts; sheaths closely convolute except at their apices and at the ramifications, oblong-lanceolate, acute, aristate, coriaceous, deeply membranous at the apex and margins, nervose-striate, 2·5–3·5 cm. long; male inflorescence containing racemes and panicles in the axils of the spathes, 5–8 cm. long; spathes deciduous, sheath-like, expanded, 4–6 cm. long; racemes and panicles crowded in the axil of each spathe, many-flowered, about half as long as the subtending spathe; bracts erect or spreading, linear, much exceeding the flowers, membranous, reddish; perianth pedicellate, 3–3·5 mm. long; segments erect-spreading, setaceous, crinkled or twisted; female inflorescence spicate-cymose, containing 1–3 spikelets, 3–4·5 cm. long; spathes deciduous, loosely convolute, sheath-like, brown, about 3 cm. long; spikelets cylindric, 2–2·5 cm. long; bracts 6–9 in each spikelet, convolute, lanceolate, acute, mucronate, cartilaginous, reddish, 1·2–2 cm. long; perianth sessile, 2–2·5 mm. long; segments arising from fleshy reddish bases, overlapping at their sides, oblong or ovate-oblong, rounded and emarginate at the apex, with or without an apicula in the notch, membranous; the inner shorter than the outer; ovary surmounted by a pitted horny cap; styles free, oblong or lanceolate, often recurved at the apex, 4–5 mm. long.

South Africa: Cape Province—Cape Div.: north slopes of Table Mt., *Pillans*, 2940, ♂ and ♀ (type).—Clanwilliam Div.: Cedar Berg, *Primos in Marloth Herb.*, 11798, ♂, 11799, monstrous, 11800, ♂ and ♀.

6. W. arescens, *Kunth, Enum.*, iii, 454 (1841)!; *Drège, Zwei Pfl. Documente*, 74 (1844); *Steud., Synops.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 271 (1868); *in DC. Monog. Phan.*, i, 393 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 524 (1895); *Mast. in Fl. Cap.*, vii, 145 (1897):

W. brevis, *Nees ex Mast. in Journ. Linn. Soc.*, x, 269, sub *W. tereti*; *Mast. in DC. Monog. Phan.*, i, 397; *Durand et Schinz, op. cit.*, v, 525.

Stems erect, moderately branched, terete, somewhat fistular, minutely yellowish-punctate, 4–10 dm. high, 1·25–1·5 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acute, aristate, coriaceous, shiny, light brown, pale-membranous at the margins and in the upper third, striate, 1·5–2 cm. long; male inflorescence 2–2·5 cm. long, containing racemes and panicles congested in the axils of the spathes; spathes 2–4, sheath-like but expanded, smooth; racemes and panicles many-flowered, oblong, 6–10 mm. long; bracts caducous, linear to linear-lanceolate, pale-membranous; perianth pedicellate, about 2 mm. long; segments setaceous, twisted, pale-membranous; female inflorescence spicate; spikelets solitary, 1-flowered, cylindric, about 1·5 cm. long; spathes as in the male but convolute; bracts about 8, broadly ovate to oblong, rounded at apex, mucronate, cartilaginous, pale reddish, 8–14 mm. long; perianth on an obscurely 6-lobed stipe, oblong, 3–5 mm. long; segments imbricate at the margins, distinctly narrowed at the base, subrotundate or subelliptic, emarginate at apex, with a small apicula in the notch, membranous, unequal; ovary oblong, surmounted by a horny cap; styles free, glabrous at base, 5 mm. long.

South Africa: Cape Province—Malmesbury Div.: Hopefield, *Bolus*, 12904, ♂, 12905, ♀, *Bachmann*, 1763, ♂.—Stellenbosch Div.: on the Stellenbosch Flats, *Duthie*, 1693, ♂.—Tulbagh Div.: Tulbagh Kloof, *Zeyher*, ♂.—Clanwilliam Div.: Ezelsbank, on the Cedarberg, *Drège*, 2522, ♂ and ♀; between Jakhals River and Klip Fontein, *Drège*, 2482, ♂ and ♀; Mossel Banks River, *Zeyher*, ♂; Cedarberg, *Primos in Marloth Herb.*, 11789, ♂.

7. W. teres, *Thunb. in Vet. Akad. Stockh.*, xi, 30, t. 2, fig. 2 (1790)!; *in Prodr. Cap.*, 14 (1794); *Poir. in Lam., Encycl. Meth.*, vi, 178 (1804); *Gaertn. Fruct. et Sem. Pl.*, iii, 7 (1805), excl. syn.; *Willd., Sp. Pl.*, iv, pars 2, 717 (1806); *Pers., Synops. Pl.*, ii, 606 (1807); *Thunb., Fl. Cap.*, ed. 1, p. 314 (1811); *Aiton, Hort. Kew.*, v, 368 (1813); *Thunb., Fl. Cap.*, ed. *Schultes*, p. 82 (1823); *Spreng., Syst. Veg.*, i, 188 (1825); *Nees in Linnaea*, v, 664 (1830); *Kunth, Enum.*, iii, 452 (1841); *Steud., Synops.*, ii, 262 (1855); *Mast. in Journ. Linn. Soc.*, x, 269 (1868), excl. descr.; *Thunb. Herb. ex Mast., op. cit.*, xiv, 421 (1875); *Mast. in DC. Monog. Phan.*, i, 392 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895); *Mast. in Fl. Cap.*, vii, 146 (1897): **Restio dichotomus,** *Gaertn. Fruct. et Sem. Pl.*, ii, 12, t. 82, fig. 3 (1791), excl. syn.: **W. fraterna,** *N. E. Br. in Fl. Cap.*, vii, 756 (1900)!: **W. Galpinii,** *N. E. Br., op. cit.*, p. 757!: **W. peninsularis,** *N. E. Br., loc. cit.*!.

Stems arising from creeping rhizomes, erect, moderately branched or simple, terete, somewhat fistular, finely rugose, with sunken yellowish

spots, 2–10 dm. high, mostly 2–3 mm. in diameter in their lower parts; sheaths closely convolute, oblong-lanceolate, acute, aristate, coriaceous, deeply membranous at the margins and apex, smooth, yellow-spotted, mostly 2·5–3 cm. long; male inflorescence 2–6 cm. long, containing racemes and panicles which are congested in the axils of the spathes; spathes deciduous, expanded during the flowering period, ovate-lanceolate, sheath-like, 2–4 cm. long; racemes and panicles densely many-flowered, shorter than the subtending spathes; bracts caducous, linear, acuminate, membranous, often crinkled and twisted, much exceeding the flowers; perianth pedicellate, 2·5–3 mm. long; segments spreading, setaceous, twisted; female inflorescence spicate-cymose, containing 1–3 spikelets; spathes deciduous, loosely convolute, sheath-like, yellowish or ferruginous, 2–4 cm. long; spikelets sessile, cylindric, 1·5–2·5 cm. long; bracts about 6, loosely convolute, ovate to oblong-lanceolate, mucronate, cartilaginous or membranous, ferruginous in the upper half, 1·5–2 cm. long; perianth on a stout, more or less distinctly lobed stipe, 1–2·75 mm. long; segments broad-based, with their margins overlapping or at least touching, suborbicular, broadly ovate, or ovate-oblong, rounded or emarginate at apex, entire or minutely toothed at the margins, or simply apiculate, membranous, unequal; ovary oblong, surmounted by a horny cap; styles free, terete, mostly 8–10 mm. long; fruit barrel-shaped, smooth, or sparsely pitted, black.

South Africa: without precise locality, *Thunberg*, ♀.

Cape Province—Cape Div.: sandy flats at Retreat, *Pillans*, 4297, ♂ and ♀; hills near Kommetje, *Galpin*, 4822, ♀, 4832, ♂.—Worcester Div.: Du Toit's Kloof, *Drège*, 1655, ♀.—Van Rhynsdorp Div.: Gift Berg, *Phillips in Sladen Expedition*, 7463, ♂.—Riversdale Div.: Garcia's Pass, *Galpin*, 4824, ♀, 4825, ♀ (monstrosity), 4831, ♂.—Prince Albert Div.: Zwartberg Pass, *Tujwell in Bolus Herb.*, 14287, ♀.—Knysna Div.: the Glebe, *Galpin*, 4830, ♀.—Uniondale Div.: headwaters of Wagenbooms River, *Fourcade*, 2344, ♂ and ♀.

8. W. sulcata, *Mast. in Journ. Linn. Soc.*, x, 270 (1868); *in DC. Monog. Phan.*, i, 395 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895); *Mast. in Fl. Cap.*, vii, 145 (1897).

Stems arising from creeping rhizomes, erect, moderately branched, rather slender, solid, sulcate- or angular-striate, 4–6 dm. high, 1·25–1·75 mm. in diameter in their lower parts; sheaths closely convolute, except at the ramifications, oblong-lanceolate, acute, aristate, coriaceous, membranous at margins and apex, 1·5–2 cm. long; male inflorescence about 3 cm. long, containing racemes and panicles which are congested in the axils of the spathes; spathes deciduous, expanded, sheath-like, up to 3 cm. long; racemes and panicles many-flowered, shorter than the subtending spathes; bracts erect-spreading, linear, acuminate, twisted and bent, membranous,

reddish, much exceeding the perianth ; perianth pedicellate, about 3 mm. long ; segments erect-spreading, linear or setaceous, reddish, unequal ; female inflorescence spicate, 1·5–3 cm. long, containing 1–3 spikelets ; spathes deciduous, loosely convolute, sheath-like ; spikelets sessile, erect, cylindric, 1-flowered, about 1·5 cm. long ; bracts 5–9, convolute, lanceolate, acute, mucronate, cartilaginous, reddish, 6–15 mm. long ; perianth upon an obconic or cylindric, entire stipe, 3–4 mm. long ; segments broad-based, embracing the ovary, imbricate at their margins, ovate, obtuse, entire, membranous, with a red median nerve ; the inner distinctly shorter than the outer, apiculate ; ovary cylindric, surmounted by a horny, pitted cap ; styles free, terete, 4 mm. long ; fruit ovate, much pitted, dark brown.

South Africa : without precise locality, *Bachmann*, 1756, ♀.

Cape Province—Cape Div. : between Wynberg and Constantia, *Burchell*, 787, ♂ ; flats near Cape Town, *Bolus*, 4435, ♂, *MacOwan*, 3043, ♀ ; Camp Ground, near Rosebank, *Bolus*, 7223, ♀ ; Diep River, *O. Kuntz*, ♀, *Potts in Grey University College Herb.*, 2186, ♂ ; Retreat, *Wolley-Dod*, 2597, monstrosity ; Red Hill, *L. Bolus in Bolus Herb.*, 17354, ♂.—Stellenbosch Div. : sandy flats at Stellenbosch, *Duthie*, 1792, ♂.—Worcester Div. : mountains above Worcester, *Rehmann*, 2556, ♀.

9. W. striata, *Thunb. in Vet. Akad. Handl. Stockh.*, xi, 29, tab. 2, fig. 1 (1790) ! ; *ejusd. Prodr. Cap.*, 14 (1794) ; *Poir. in Lam., Encycl. Meth.*, vi, 178 (1804) ; *Willd., Sp. Pl.*, iv, pars 2, 717 (1806) ; *Pers., Synops. Pl.*, ii, 606 (1807) ; *Thunb., Fl. Cap.*, ed. 1, 312 (1811) ; ed. *Schultes*, p. 82 (1823) ; *Kunth, Enum.*, iii, 453 (1841) ; *Drège, Zwei Pfl. Documente*, 77, 104 (1844) ; *Steud., Synops.*, ii, 262 (1855) ; *Mast. in Journ. Linn. Soc.*, x, 270 (1868) ; *Thunb. Herb. ex Mast., op. cit.*, xiv, 421 (1875) ; *Mast. in DC. Monog. Phan.*, i, 394 (1878) ; *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895) ; *Mast. in Fl. Cap.*, vii, 144 (1897) ; *in Ann. K.K. Natur. Hofm.*, Band xv, No. 1, p. 12 (1900) : **Restio incurvatus,** *Thunb., Diss.*, 18 (1788), monstrosity ! ; *in Usteri, Delect.*, i, 53 (1790) ; *ejusd. Prodr. Cap.*, 15 ; *Poir. in Lam., Encycl. Meth.*, vi, 170 ; *Willd., Sp. Pl.*, iv, pars 2, 726 ; *Pers., Synops. Pl.*, ii, 607 ; *Thunb., Fl. Cap.*, ed. 1, 334 ; ed. *Schultes*, 88 ; *Spreng., Syst. Veg.*, i, 185 (1825) ; *Mast. in Journ. Linn. Soc.*, xiv, 418 : **Nematanthus Ecklonii,** *Nees in Linnaea*, v, 662 (1830) ! ; *op. cit.*, vii, 618 (1832) : **W. Ecklonii,** *Kunth, Enum.*, iii, 456 ! ; *Steud., Synops.*, ii, 263 : **W. neglecta,** *Steud., loc. cit.* ! : **W. cuspidata,** *Mast. in Journ. Linn. Soc.*, x, 271 (1868) ! ; *in DC. Monog. Phan.*, i, 396 ; *Durand et Schinz, Consp. Fl. Afr.*, v, 525 ; *Mast. in Fl. Cap.*, vii, 144.

Stems usually caespitose, erect, branching several times, rigid, solid, sulcato-striate, terete, 8–15 dm. high, 2·5–4 mm. in diameter at the middle, up to 6 mm. in diameter in the lower parts ; sheaths loosely convolute,

often somewhat expanded and erect-spreading at the apex, oblong-lanceolate, acute, aristate, coriaceous, nervose-striate, reddish, broadly white-membranous at the apex, up to 4 cm. long on the main stems; male inflorescence containing many-flowered racemes and panicles which are tufted in the axils of the spathes, 3–4 cm. long; spathes caducous, usually 3 or 4, expanded, sheath-like, purple-brown at apex, 2·5–3 cm. long; racemes and panicles about 1 cm. long; bracts caducous, on the rhaches or on the pedicels, linear-lanceolate to setaceous, aristate, membranous, pale reddish, 8–15 mm. long; perianth-segments setaceous, membranous, 2·5–4 mm. long; female inflorescence composed of solitary spikes, cylindric, 2–3 cm. long; spathes as in the male but loosely convolute; bracts about 10 in each spike, spathe-like but smaller inwards; perianth solitary, sessile, closely clasping the ovary and reaching to the base of the styles, 2–3 mm. long; segments broad-based, overlapping at their margins, broadly ovate, obtuse and more or less emarginate at the apex, with or without an apicula in the notch, or acute, membranous, subequal, or the outer exceeding the inner; styles arising from a warty, greenish stylopodium, broad-based, free or united, suborbicular, fleshy, 1–2 mm. long; fruit ovate-oblong, smooth or variously pitted, black.

South Africa: without precise locality, *Thunberg*, ♂ and ♀, *Sparmann*, ♂, *Bachmann*, 1753, ♂.

Cape Province—Cape Div.: Cape Flats, *Bolus*, 4467, monstrosity; base of the Muizenberg, *Bolus*, 4458, ♀, 4459, ♂; Fish Hoek, *Page in S.A. National Herb.*, 1027, ♂; Simon's Town, *Marloth*, 3176, ♀; plateau west of Red Hill, *Pillans*, 3409, ♂ and ♀; "Cape Peninsula," *R. and T. Fries*, 3090, ♀; Koeberg, *Pappe in Herb. Mus. Austr.-Afr.*, 12857, ♀.—Malmesbury Div.: St. Helena Bay, *Hove*, ♂, *Marloth*, 8219, ♀; Darling, *Marloth*, 8422, ♂.—Stellenbosch Div.: Marais Park, *Duthie*, 1792*a*, ♂.—Paarl Div.: Berg River, *Drège*, 1645, ♂; Dal Josephat, *Tyson*, 861, ♀.—Piquetberg Div.: between Twenty-four Rivers and Piquiniers Kloof, *Drège*, 2520, ♂.—Clanwilliam Div.: Brakfontein, Olifants River, *Zeyher*, ♂; Lange Vley, *Zeyher*, 1736, ♂ and ♀; near Piquiniers Kloof, *Schlechter*, 4931, ♀, 4933, ♂.—Worcester Div.: Hex River Valley, *Bolus*, 13221, ♂, 13222, ♀, *Tyson*, 609, ♀; Touws River, *Marloth*, 3152, ♀, 3160, ♂.—Tulbagh Div.: Winterhoek, *Drège*, 2516, ♀.—Van Rhynsdorp Div.: Gift Berg, *Marloth*, 3115, ♀.—Little Namaqualand: sand dunes 6 miles east of Hondeklip Bay, *Pillans in Bolus Herb.*, 17935, ♀.

10. W. Bolusii, *Pillans*, sp. nov.; culmis ramisque teretibus striatis impressis; vaginis oblongo-lanceolatis aristatis; floribus masculis in axillares racemos vel paniculas dispositis; spiculis femineis 2–4 sessilis; spathis subpersistentibus lanceolatis aristatis coriaceis marginibus purpureis; bracteis circa 6 arcte convolutis lanceolatis aristatis; flore unico stipite

lobato; segmentis orbicularibus membranaceis marginibus imbricatis; stylis liberis teretibus; fructibus cylindraceis laevibus nigrescentibus.

Stems erect, sparingly branched, terete, solid, striate and much pitted, 5–9 dm. high, 2–3 mm. in diameter at the middle; sheaths closely convolute, oblong-lanceolate, acute, aristate, coriaceous, nervose-striate and pitted, 2–4 cm. long; male inflorescence 6–8 cm. long, containing racemes and panicles clustered in the axils of the spathes; spathes deciduous, sheath-like but loosely convolute or expanded during the flowering period, light brown on the outer surface, purple at the margins and apex, 3–5 cm. long; racemes and panicles many-flowered, much shorter than the subtending spathes; bracts deciduous, linear or setaceous, membranous, much exceeding the flowers; perianth pedicellate, 3–4 mm. long; segments erect-spreading, linear or setaceous, membranous, light brown, becoming reddish; the outer segments much exceeding the inner; female inflorescence spicate, 4–7 cm. long, containing 2–4 spikelets; spathes subpersistent, loosely convolute, lanceolate, aristate, coriaceous, nervose-striate, light brown, purple at the margins, 3–4 cm. long (including the awns); spikelets sessile, narrow-cylindric, 1-flowered, 1·5–1·8 cm. long; bracts about 6, closely convolute, lanceolate, aristate, 1·2–1·8 cm. long; perianth on a 6-lobed, oblong stipe, 1·5 mm. long; segments imbricate at their margins, orbicular, apiculate, equal, membranous; styles free, terete, bearing long stigmatic hairs, 1–1·2 cm. long; fruit cylindric, depressed at apex, smooth, black.

South Africa: Cape Province—Riversdale Div.: rocky slopes in Garcia's Pass, *Bolus*, 17355, ♀; Phisantefontein, north slopes of the Lange Bergen, *Muir*, 3193, ♂, 3194, ♀ (type).

11. W. purpurea, *Pillans*, sp. nov.; culmis decumbentibus erectis, gracilibus teretibus a basi divisis; vaginis laxiusculis lanceolatis vel oblongo-lanceolatis mucronatis vel aristatis; spiculis femineis 1–3 breviter pedunculatis 1-floris; spathis deciduis laxiusculis lanceolatis aristatis purpureis; bracteis arcte convolutis lanceolatis acutis membranaceis; perianthio segmentis rudimentis 3, oblongis obtusis carnosis; ovario breviter stipitato oblongo corneo stylopodio superato; stylis liberis gracilibus.

Stems arising from creeping rhizomes, erect, moderately branched from the base upwards, slender, terete, minutely rugulose, 3–5 dm. high; sheaths loosely convolute, lanceolate or oblong-lanceolate, acute, aristate, or occasionally obtuse and stoutly mucronate, coriaceous, thinner at the apex and margins, red-brown, or those at the upper nodes purplish, mostly 2–2·5 cm. long with the mucro or awn; female inflorescence spicate, linear or linear-oblong, 2·5–4·5 cm. long; spathes persisting during the flowering period, eventually falling, loosely convolute, lanceolate, acuminate, aristate, cartilaginous or chartaceous, finely nervose-striate, purple, brownish and membranous at the apex, 2–3 cm. long; spikelets 1–3 in each inflorescence.

shortly pedunculate, 1-flowered, partly hidden by the spathes; spathellae solitary, broad-based, ovate, acute, hyaline-membranous, 3–3·5 mm. long; bracts 5 or 6 in each spikelet, closely enfolding each other, lanceolate, acute, with a soft apicula, hyaline-membranous, brown-speckled, 7–8 mm. long; perianth sessile, composed of 3 rudimentary oblong, obtuse, pale and fleshy segments, 0·5 mm. long; ovary shortly stipitate, oblong, with a soft, wrinkled green coat, surmounted by a hard conical cap; cap terete, shortly bifid at its apex, minutely papillate, buff-coloured, 2·5 mm. long; styles free at base, slender, moderately villous on the stigmatic surface, 4–5 mm. long.

South Africa: Cape Province—Caledon Div.: in Viljoen's Pass, *Pillans*, 4811, ♀ (type).

12. W. humilis, *Mast. in Journ. Linn. Soc.*, x, 272 (1868)!; *in DC. Monog. Phan.*, i, 396 (1878); *Durand et Schinz, Consp. Fl. Afr.*, v, 525 (1895); *Mast. in Fl. Cap.*, vii, 144 (1897): **Hypodiscus Dodii,** *Mast. in Journ. Bot.*, xxix, 402 (1901)!.

Stems erect, simple, slender, terete, fistular, wrinkled, 2–3 dm. high, 1 mm. in diameter; sheaths tightly convolute, oblong-lanceolate, acute, slender-aristate, coriaceous, deeply white-membranous at the margins, 1·5–2·5 cm. long; male inflorescence spicate-cymose, linear, 3–10 cm. long; spathes caducous, sheath-like, about 1·5 cm. long (excluding the awns), expanded; spikelets solitary in the axils of the spathes, erect, laxly many-flowered, 8–12 mm. long; bracts caducous, expanded, linear to linear-lanceolate, acute, membranous, 5–6 mm. long; perianth sessile, 3–4 mm. long; segments 3, caducous, setaceous, somewhat bent; female inflorescence spicate, linear, compact, bearing 1–3 spikelets, 3–5 cm. long; spathes persistent, sheath-like, tightly enveloping the spikelets, about 1·5 cm. long; bracts 4 in each spikelet, quite hidden by the spathes, closely convolute, lanceolate, acute, membranous, 8–10 mm. long; perianth sessile, linear-cylindric, 5–6 mm. long; segments 5 or 6, linear-lanceolate, apiculate, membranous, unequal; staminodes 2–4, minute; ovary sessile, narrow-oblong, rugulose, surmounted by a soft, unequally lobed disc; styles free, comparatively long, filiform in their upper parts, glabrous in their lower, 1·2–1·5 cm. long; fruit sessile, cylindric, with its surface divided into variously shaped sections, unevenly toothed round its summit, bony, blackish, distinctly exceeding the perianth in length, 7–7·5 mm. long.

South Africa: Cape Province—Cape Div.: Doornhoogte, on the Cape Flats, *Ecklon*, 867, ♂ and ♀; Cape Flats, *Bolus*, 4435, ♂, *Schlechter*, 489, ♀, *Pillans*, 3392, ♀; flats between Retreat and Steenberg, *Wolley-Dod*, 2578, ♂, *Pillans*, 3132, ♂ and ♀, 4359, ♀; plateau on the Steenberg, *Wolley-Dod*, 2720, ♀.

XI, ANTHOCHORTUS, *Nees in Lindl. Nat. Syst. Bot.*, ed. 2, p. 451 (8361); *Endl., Gen. Pl.*, 121 (1836); *Kunth, Enum.*, iii, 485 (1841); *Meisner, Gen.*, 408 (1842); *Steud., Synops. Pl.*, ii, 247 (1855); *Harvey, Gen. S. Afr. Pl.*, ed. 2, p. 416 (1868); *Mast. in Journ. Linn. Soc.*, x, 274 (1868); *in DC. Monog. Phan.*, i, 398 (1878); *in Fl. Cap*, vii, 148 (1897).

Flowers dioecious. Male spikelets solitary and terminal or on lateral branchlets, linear, laxly 2–4-flowered, with deciduous bracts. Perianth subterete; segments 6, membranous, equal, the outer lateral navicular. Anthers linear, apiculate. Rudimentary ovary absent. Female spikelets solitary, terminal on the main stem or on lateral branchlets, containing one lower bract with a fertile flower and one upper bract with a rudimentary flower. Perianth oblong, terete; segments 6, membranous, equal. Staminodes ligulate. Ovary obovate, 1-celled; styles 2, connate at base, diverging upwards. Fruit oblong, indehiscent.

Flowering stems tufted, erect, sparingly branched, slender, terete or subquadrate, sulcate-striate. Leaf-sheaths persistent, loosely convolute.

The genus is endemic.

1. A. Ecklonii, *Nees in Lindl. Syst. Veg.*, ed. 2, p. 451 (1836)!; *Kunth, Enum.*, iii, 486 (1841); *Steud., Synops.*, ii, 247 (1855); *Mast. in Journ. Linn. Soc.*, x, 274 (1868); *in DC. Monog. Phan.*, i, 398 (1878); *in Fl. Cap.*, vii, 148 (1897): **Hypolaena tenuis,** *Mast. in DC. Monog. Phan.*, i, 372!; *Durand et Schinz, Consp. Fl. Afr.*, v, 522 (1895); *Mast. in Fl. Cap.*, vii, 134: **Willdenowia Ecklonii,** *Durand et Schinz, op. cit.*, p. 525, non *Endl.*

Stems caespitose, erect, sparingly branched, terete or subquadrate, filiform, sulcate-striate, often purplish in the furrows, 2–4 dm. high, 0·75 mm. in diameter at the middle; sheaths rather loosely convolute, linear-lanceolate, acute, with a long, very slender awn, coriaceous, broadly white-membranous at the sides and apex, conspicuously sulcate-striate, at first purplish, 1–2 cm. long without the awn; male spikelets terminal or on lateral branchlets, solitary, linear, 2–4-flowered, 8–15 mm. long; spathes deciduous, sheath-like but smaller; bracts caducous, linear, acuminate, membranous, much exceeding the flowers; flowers separated on the rhachis of the spikelet by nearly their own length; perianth sessile or shortly stipitate, linear-oblong, subterete, 2–3·5 mm. long; segments linear-oblong, obtuse, apiculate, membranous, pale, equal; the outer lateral navicular, with a slightly prominent midrib; anthers linear, apiculate; female spikelets terminal or on short lateral branchlets, solitary, containing one lower bract with a fertile flower and one upper bract with a rudimentary flower, mostly 6–10 mm. long; spathe persistent, navicular, sheath-like but smaller; lower bract persistent, erect-spreading, navicular, linear-lanceolate, acuminate, with a caducous, slender awn, pale, membranous, about 5 mm. long; upper bract resembling the lower but about

half its length ; perianth sessile, oblong, terete, 1·75 mm. long ; segments lanceolate-oblong, obtuse, minutely apiculate, dorsally rounded, membranous, with a red, median nerve, equal ; ovary obovate, broadest and firmest at the apex, subtrigonous, 1 mm. long ; styles 2, 0·25 mm. long, united at base, diverging upwards, narrow-deltoid, having the inner surface entirely covered by stigmatic hairs.

South Africa : Cape Province—Paarl Div. : Bain's Kloof, *Schlechter*, 9177, ♀.—Swellendam Div. : Puspas River, *Ecklon and Zeyher*, ♂ ; summit of a mountain-peak near Swellendam, *Burchell*, 7360, ♀ ; Lange Bergen, near Zuurbraak, *Schlechter*, 2115, ♂.—Riversdale Div. : lower part of the Lange Bergen, near Kampsche Berg, *Burchell*, 7028, ♂ ; Lange Bergen, *Schlechter*, 1920, ♂.

XII, PHYLLOCOMOS, *Mast. in Engler Bot. Jahrb.*, xxix, Beibl. 66, p. 19 (1900).

Flowers hermaphrodite. Perianth hidden by the bract, oblong, terete ; segments 6, on the outer side rounded or the outer lateral somewhat angled, glabrous, subequal. Anthers linear, falling as the fruit develops. Ovary narrowly ovate, 1-celled ; styles 2, free. Fruit smooth or slightly rough at the apex, indehiscent.

Flowering stems arising from creeping rhizomes, erect, slender, terete, obscurely sulcate, scabrid, sparingly branched. Leaf-sheaths persistent, closely convolute, aristate, with broad, hyaline-membranous margins. Inflorescence containing a terminal, occasionally also a lateral tuft of pedunculate 1-flowered spikelets. Bracts many, erect-spreading, aristate, membranous, pale.

The genus is endemic.

1. P. insignis, *Mast. in Engl. Bot. Jahrb.*, xxix, Beibl. 66, p. 19 (1900) !.

Stems arising from creeping rhizomes, erect, slender, terete, solid or somewhat fistular, scabrid, obscurely sulcate, sparingly branched, 5–7 dm. high ; sheaths closely embracing the stem, oblong-lanceolate, acute, with a slender awn, coriaceous, externally rough with tubercles arranged in irregular rows, broadly hyaline-membranous at the margins, 2–3 cm. long ; inflorescence paniculate-cymose, dense, 2–3 cm. long, containing about 9 spikelets ; spathes sheath-like, yellow-speckled, overtopping the spikelets ; spathellae linear-lanceolate, acuminate, with a spreading or recurved awn, membranous, with a prominent, rigid midrib, pale ; spikelets pedunculate, linear-oblong, 1-flowered, 1–1·2 cm. long ; bracts 6 or 7, loosely clasping in the lower part, erect-spreading upwards, linear-oblong, acute, aristate, pale-membranous, with a rigid midrib, often serrate or slightly lacerate at the upper margins, 6–10 mm. long with the awn ; flowers bisexual, terminal, deciduous ; perianth stipitate, oblong, terete, 4 mm.

long; segments oblong-lanceolate, subacute, dorsally rounded or the outer lateral somewhat angled, membranous or cartilaginous, glabrous, pale or reddish at the apex, subequal; stamens opposite and often shortly attached to the base of the inner segments; anthers linear, minutely apiculate, falling with the development of fruit; ovary narrow-ovate, glabrous, 1-celled; styles 2, free; fruit smooth or minutely scabrid at the apex, indehiscent.

South Africa: Cape Province—CERES DIV.: mountains in Mitchell's Pass, *Schlechter*, 9956.

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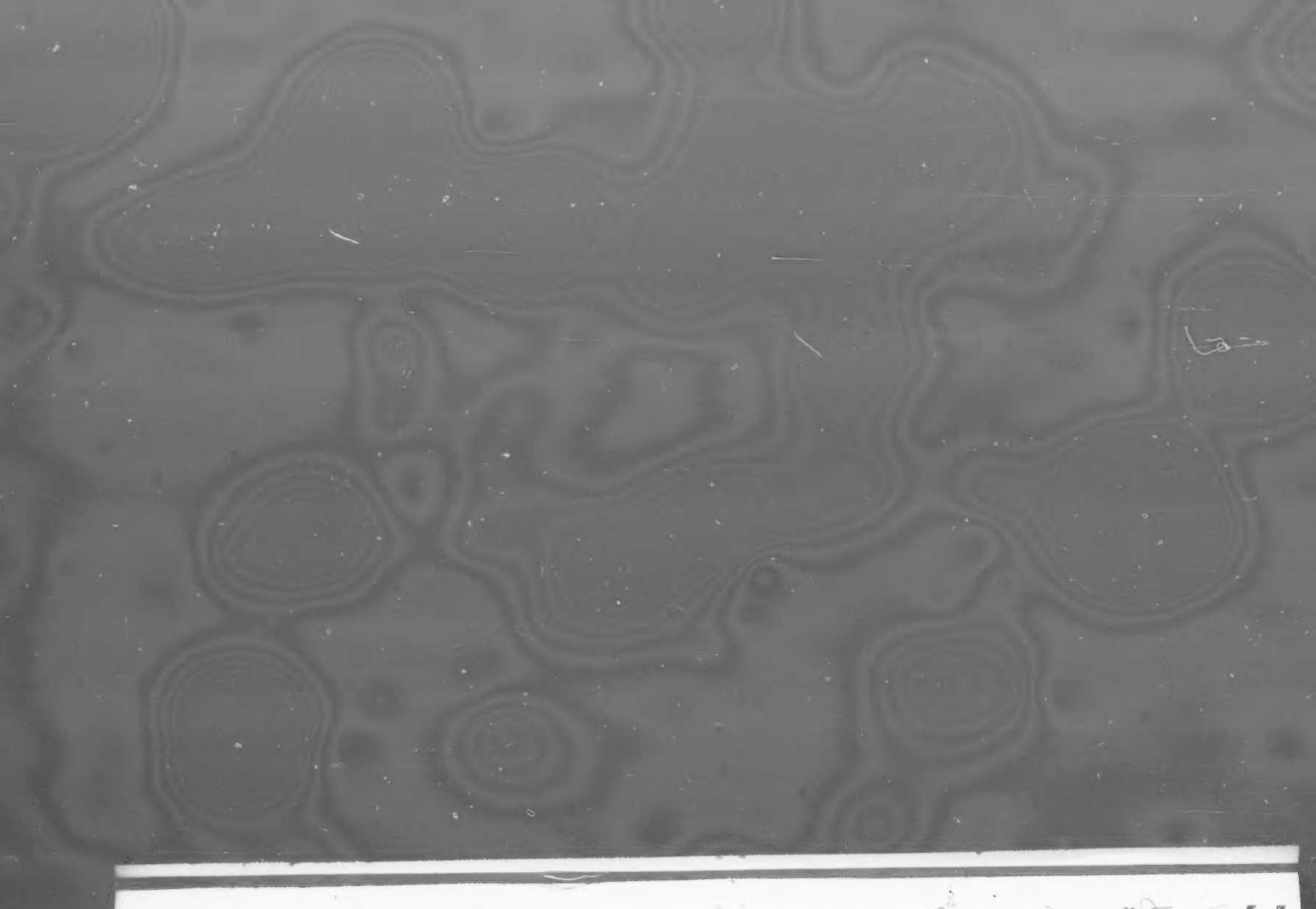
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